CHRISTENSEN ASSOCIATES ENERGY CONSULTING

Meeting Commonwealth Edison's Distribution Allocation Requirements from Illinois Commerce Commission Order 10-0467

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1. Introduction and Purpose of the Study

This report summarizes the methods used by Christensen Associates Energy Consulting ("CA Energy Consulting") and SAIC (together referred to as "the project team") to assist Commonwealth Edison Company ("ComEd") in meeting the requirements contained in the Illinois Commerce Commission's ("ICC's" or "the Commission's") Order for Docket No. 10-0467 ("the 2010 Order"). There are five areas contained in the 2010 Order that the project team has addressed:

1. *Direct observation*. Using direct observation to refine the cost allocation of select facility types.[1]
2. *Circuit sample representativeness*. Analyzing the representativeness of a sample of circuits used by ComEd in ComEd Exhibit 21.6 of Docket No. 10-0467.[2]
3. *Survey of distribution costing methods*. Surveying utilities to understand the distribution costing methods used elsewhere.[3]
4. *Allocation of primary voltage costs for Railroad Class and Extra Large Load ("ELL") Class Customers*. Dividing primary voltage distribution costs into 4kV and above 4kV categories[4] and properly allocating each category to Railroad and ELL customers.[5]
5. *Extra Large Load Assets and the Analysis of Rider NS – Nonstandard Services and Facilities ("Rider NS")*. Examining ComEd's methods of handling Rider NS costs and revenues for the assets used to serve Extra Large Load customers to determine whether cross-subsidies exist and ensure that the level of cost recovery is appropriate.[6]

Item 3, the survey of distribution costing methods used at other utilities, is addressed in a separate report.[7] The other items, all of which relate to distribution costing practices, are addressed in this report. ComEd was directed to work with ICC Staff[8] on several of these items. Consequently, the project team along with ComEd provided periodic updates to the ICC Staff on the approach and progress of each of these items. ICC Staff provided helpful feedback at various times to ensure ICC directives are met.

The report is organized as follows. Section 2 describes the use of direct observation to allocate specific distribution facilities to secondary and shared voltage cost categories.[9] Section 3 describes the methods used to separate shared distribution costs into 4kV and above 4kV distribution cost categories. Section 4 contains an analysis of the representativeness of a sample of circuits used by ComEd in Docket No. 10-0467. Section 5 contains a study of ComEd's handling of Rider NS costs and revenues.

[1] Final Order, Docket No. 10-0467, pages 177-181.
[2] *Ibid*., pages 181-182.
[3] *Ibid*., pages 183-185.
[4] "4 kV" is used to denote voltages of 4.16 kV.
[5] *Ibid*., pages 185-191.
[6] *Ibid*., pages 192-196.
[7] Christensen Associates Energy Consulting, *Survey of Approaches to Distribution Cost Allocation by Voltage*, report to ComEd, October 2011.
[8] *Ibid*, pages 180-181, 182, 185
[9] Shared costs are allocated to both primary and secondary voltage service points.

2. Direct Observation of ComEd Distribution Facilities

The 2010 Order contains a requirement that ComEd use direct observation to allocate a sub-set of costs for which ComEd had used "engineering estimates."[10] Specifically, direct observation is to be used to allocate the cost of the following facilities between primary and secondary costs:

- Underground conduit outside the City of Chicago;
- Weather-resistant wire (WRW);
- Poles 50 feet or lower in height;
- Poles taller than 50 feet in height; and
- Poles that carry both primary and secondary equipment.

This section describes the approach taken by the project team to employ direct observation in the allocation of these facilities between primary and secondary costs.

2.1 Sample Design Methodology

The project team began by establishing sample sizes using a standard formula for sampling for proportions. This formula assumes simple random sampling and a binomial distribution model. Using this formula, the approximate[11] sample size required to provide a margin of error *d* for proportion *p* is:

$$n_0 = \frac{t^2 p(1-p)}{d^2}$$

where *t* determines the statistical confidence level associated with *d* (e.g., *t*=1.645 for 90 percent confidence based on the normal distribution). See William G. Cochran, *Sampling Techniques (3rd Edition)* (Wiley, 1977), pp. 75-76.

When considering the tradeoff between the efficiency of the estimates (e.g., of the amount of WRW used in secondary voltage applications) and the total cost of the effort, particularly for purposes of testing the engineering estimates previously used by ComEd, the project team determined that a sample size of approximately 150-160, which provides a 20 percent margin of error for *p*=0.3 (*d*=0.06) at a 90 percent confidence level, is reasonable. The proportion *p* corresponds to the ComEd assumption being tested, which in this case is the assumption that 30 percent of WRW is allocated to primary.

The project team also determined the approximate sample size for *p*=0.01, which corresponds to ComEd's assumption that 1 percent of the underground conduit outside the City of Chicago is allocated to secondary costs. In this case, providing traditional levels of relative precision (e.g., a 10 or 20 percent relative margin of error at an 80 percent or 90 percent confidence level) would require a prohibitively large sample size.[12] Specifically, the field observation team would have needed to inspect approximately 85 percent of ComEd's circuits, or more than 10,000 additional miles of circuits. Because

[10] Final Order, Docket No. 10-0467, pages 177-181.
[11] This formula does not incorporate a finite population correction.
[12] The required sample size for a given level of relative precision increases as the proportion *p* moves away from *p*=0.5.

the circuit sample was designed according the WRW proportion (p = 0.3), the relative margin of error is higher for the underground conduit outside the City of Chicago (for which p = 0.01). However, the absolute margin of error is small.[13]

The project team implemented a stratified sample design to ensure appropriate representation of various types of circuits, and to reduce the variance of the sample-based estimates due to the lengths of sampled circuits. The project team assigned circuits to "bins" based on circuit types defined as the combination of operating voltage (4kV, 12kV, 4kV and 12kV, 34.5kV) and location (inside or outside the City of Chicago). The assignments excluded circuits in the City of Chicago that are entirely underground (601 feeders); and circuits outside the City of Chicago that are less than 500 feet in total length (41 feeders). Circuits that were entirely underground were excluded because no facilities could be observed without digging or inspecting manholes, which Staff agreed is beyond the scope of this effort. Circuits outside the City of Chicago that are especially short in length were excluded to ensure that the field inspection resources were not used to inspect trivially small portions of ComEd's distribution system.

The project team allocated a preliminary sample size of 150 circuits to bins in proportion to the circuit counts by bin. If the proportional allocation assigned fewer than 10 sample points to a bin, a minimum sample size of 10 was specified for the bin, which increased the overall circuit sample size to 159 circuits, as shown in Table 1 below.

Table 2.1. Sample Allocation to Circuit "Bins"

Bin	Voltage	Location	Bin Population	Bin Sample Size
11	4kV	Outside Chicago	628	20
12	4kV	Chicago	407	13
21	4kV & 12kV	Outside Chicago	709	22
22	4kV & 12kV	Chicago	113	10
31	12kV	Outside Chicago	2,252	69
32	12kV	Chicago	479	15
41	34kV	Outside Chicago	305	10
Total			4,893	159

Because circuit length varies widely within bins, and the quantities of conduit, WRW, and/or poles to be observed may be more variable on longer circuits, the project team stratified circuits within bins by total circuit length. Two strata were established for most bins, but three strata were established for the bin for 12kV circuits outside the City of Chicago. The project team determined stratum breakpoints using the Dalenius-Hodges rule and used the Neyman allocation to assign bin samples to the resulting strata. See Cochran (op. cit.), pp. 99; 127-131. Relative to simple random sampling by bin, the stratified design samples longer circuits at higher rates.

[13] The estimated margin of error is slightly more than one percentage point, though the lower bound for the proportion is zero.

Sample circuits for two of the strata for 12kV circuits outside the City of Chicago were selected in a different manner from the majority of the sampled circuits. The circuits in the two "shorter" strata, which account for 26 of the 156 sampled circuits, as shown in Table 2.2, were inadvertently selected in ascending order of size within the strata rather than randomly in the strata. The selection error was addressed by using the circuits selected in the second strata (which all have lengths that are near the breakpoint between the first and second strata) to represent the circuits for the combination of the two strata. An investigation found that the actual circuit sample employed represented population characteristics including the mix of overhead and underground facilities, the mix of customers by rate category, and the geographic distribution of circuits, approximately as well as the planned stratified random sample. Consequently, the project team proceeded to analyze the field observation data with an adjustment for the systematic difference in the average length of the selected circuits versus the population average for the associated strata. Table 2.2 shows the targeted and actual sample sizes by bin and stratum.

Table 2.2 Targeted and Actual Sample Sizes by Bin and Stratum

Bin	Voltage	Location	Stratum	Length (mi)	Stratum population	Targeted sample size	Actual Sample Size
11	4kV	Outside Chicago	1 (shorter)	<3.25	453	7	7
11	4kV	Outside Chicago	2 (longer)	>=3.25	175	13	14
12	4kV	Chicago	1	<2.5	260	5	5
12	4kV	Chicago	2	>=2.5	147	8	8
21	4 & 12kV	Outside Chicago	1	<29.5	521	7	7
21	4 & 12kV	Outside Chicago	2	>=29.5	188	15	15
22	4 & 12kV	Chicago	1	<8	66	5	5
22	4 & 12kV	Chicago	2	>=8	47	5	5
31	12kV	Outside Chicago	1	<29	2,044*	18	26*
31	12kV	Outside Chicago	2			19	
31	12kV	Outside Chicago	3	>=29	208	32	39
32	12kV	Chicago	1	<5.75	289	8	8
32	12kV	Chicago	2	>=5.75	190	7	7
41	34kV	Outside Chicago	1	<11.5	177	3	4
41	34kV	Outside Chicago	2	>=11.5	128	7	6
Total					4,893	159	156

* Strata 31-1 and 31-2 were combined for the final analysis.

2.2 Field Observation Methodology

The team of SAIC (formerly Patrick Energy Services Inc.) and PEI (Patrick Engineering Inc.) performed the field inspection of the ComEd distribution circuits. SAIC organized the field observation task and engaged PEI to conduct the field study and report the results. The SAIC and PEI teams have worked with ComEd in distribution field design dating back to the year 2000, having completed in excess of 15,000 designs of ComEd's distribution construction work orders prior to the acquisition of Patrick Energy Services Inc. by SAIC in May of 2011. Because of this experience, SAIC and PEI staff are very familiar with the ComEd distribution systems.

A field technical team of seven was selected to execute the field observation tasks. The team consisted primarily of ComEd retirees with well over 30 years of experience in technical and management careers in the ComEd Energy Delivery group, as well as more recent experience working directly for PEI and SAIC executing ComEd project work.

The SAIC team worked with CA Energy Consulting to develop a methodology for the field team to execute the observation tasks, and developed the list of 159 circuits to be inspected from a random stratified sample of ComEd's active distribution circuits. The basic task involved starting the reviews at a randomly selected customer location on each sample circuit, and documenting the relevant information (i.e., the observed facilities of interest, such as poles and WRW) from that customer location back to the source substation, following the electrical path of the circuit.

The assigned task required field observation of the incidence of WRW (system wide) and underground conduit (outside the City of Chicago only), as well as a sampling of the wood poles. Observations for each facility type were recorded in a field inspection check list, which included operating voltage, length and number of conductors, length and number of conduits, the location code, wood pole height and class, pole number, phase configuration, the operating voltage of circuits on poles, and equipment installed on poles. In addition, a field sketch of the electrical path of the circuit from the customer meter back to the substation was drafted for each circuit, with relevant information such as the locations of the recorded facilities and line lengths.

This process is summarized in the outline below, with additional details provided regarding the information recorded for each facility type.

1. Purpose
    a. Walk down 159 ComEd distribution circuits from a randomly selected customer location on each circuit back to the beginning of the identified circuit.
    b. The circuits were selected through a statistically valid sampling method of all ComEd distribution circuits inside and outside the City of Chicago.
2. Methods
    a. Observe, identify, measure, and document the following items:
        i. WRW including operating voltage, length of individual sections, number of wires, and the use type.
        ii. ComEd-owned underground conduit outside the City of Chicago, including operating voltage of cables within the conduit, length and number of conduits. Field observers used their experience and knowledge of ComEd construction practices and operating maps to identify locations of conduit.
        iii. Sampling of poles determined by CA Energy Consulting through a random sampling of the starting pole and every tenth pole from that

location back to the beginning of the circuit. The first pole from the meter was also recorded for all circuits. Documented pole data including operating voltages of circuits attached to the pole, height, class, and equipment were documented.

b. *A Field Observation Check List* was used to record the data. The check list includes lists of weather-resistant wire type codes, voltage codes, and pole equipment codes to maintain consistent record keeping across the team of field observers.
c. Short field measurements (less than 400 yards) were made with laser range finders having an accuracy of +/- 1 yard and a range of 400 yards. Longer measurements were determined from scale accurate GIS maps once the route was field verified by the inspector.

3. Data Management
   a. Data collected from the field observers was transcribed to an Excel worksheet and provided to CA Energy Consulting for analysis and determination of:
      i. Poles, to determine whether there is secondary, primary, or shared equipment (and the nature of the equipment where it is shared);
      ii. Underground conduit outside the City of Chicago, to determine the allocation between primary and secondary; and
      iii. WRW, to determine the allocation between primary and secondary.

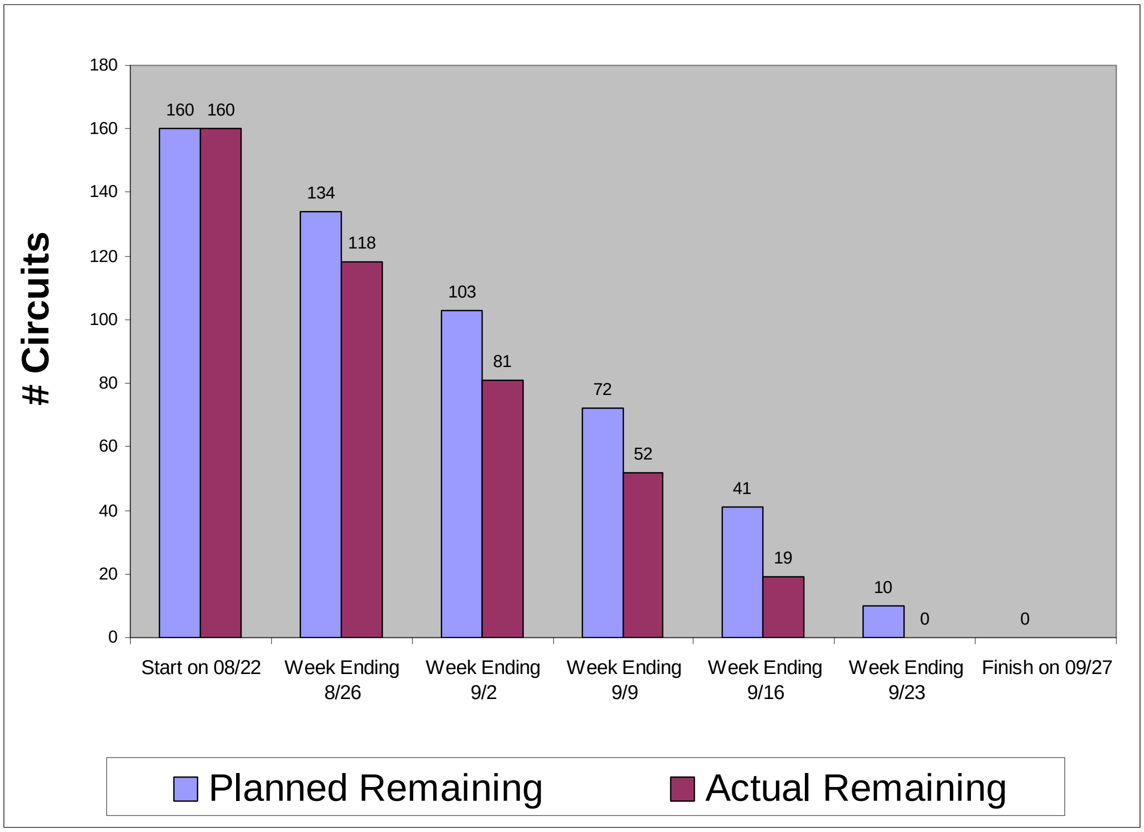
Field Team Execution

The SAIC management staff identified and mapped all of the selected circuit locations on a geographical map of ComEd's service territory. This allowed for the development of a plan to most efficiently dispatch the field observation team, minimizing time and travel based on the home locations of the team members. This process was vital to avoid team members crossing paths on the highway and consuming time and travel unnecessarily. For some of the remote areas in the service territory, overnight lodging was necessary to accommodate efficient and timely completion of assigned circuits in the area.

Prior to the beginning of the effort, the field observation team was assembled for a kick-off meeting at the PEI office in Lisle, IL. The management team explained the scope of the effort and trained the team on the use of the tools and checklist, and stressed the need for consistency in data collection. Assignments were distributed and the teams were dispatched to begin the field observations. The first incoming reports were analyzed by the management team, questions and comments were resolved, and refinements of the process were distributed to the entire field team. The circuit observations proceeded ahead of schedule through to the end of the project.

The SAIC/PEI management team collected, processed, and distributed results to the CA Energy Consulting each week as the project continued. A work-down bar chart showed the planned and actual circuits completed on a weekly basis and reported to both CA Energy Consulting and ComEd. The field project was completed one week ahead of schedule, with a total effort of approximately five weeks. Figure 2.1 is the final work-down chart.

Figure 2.1 ComEd Field Inspection Work-Down Chart



2.3 Methodology for Expanding Sample Data

This section describes estimation procedures for the data collected during the field reviews. The estimation procedures need to account for two main methodological issues. First, the project team selected the feeders to be observed using stratified random sampling. Second, SAIC examined only a portion of the selected feeders. Specifically, the field review team observed the sampled circuits along the path from a randomly selected meter point back to the substation. In contrast to a method that examines the entirety of each circuit, the implemented method allowed for the examination of a much larger sample of circuits for the same level of cost and effort.

Given the sampling and data collection methodology, the estimation process has two main steps. First, the data observed for a given feeder is expanded to represent the entire circuit. Second, the feeder-level data are expanded to reflect the feeder sampling.

Stage 1: Expanding Field Observations to Circuit Totals

As a result of reviewing the path from a randomly selected customer meter point to the substation, the field review team observed different fractions of the primary- and secondary-voltage systems. Accordingly, the proposed expansion method uses different expansions for WRW, poles, and conduit utilized for secondary and primary voltage facilities. To account for the observation method, secondary distribution and transformer tap WRW, poles with only secondary voltage wire, and secondary conduit, are expanded using the number of transformers on feeder *i*:[14]

$$y_{expanded,i} = transformers_i \cdot y_{observed,i}$$

where $y_{expanded,i}$ is the scaled number of units for the facility of interest (e.g., feet of WRW in a transformer tap) on feeder *i*; $transformers_i$ is the number of transformers on feeder *i*; and $y_{observed,i}$ is the observed number of units for the facility of interest (e.g., feet of WRW in a transformer tap) on feeder *i*.

Primary circuit conductor and tap wire for equipment other than transformers is expanded using the ratio of total to observed primary circuit length:

$$y_{expanded,i} = \left(total\_circuit\_length_i / observed\_primary\_length_i\right) \cdot y_{observed,i}$$

where $total\_circuit\_length_i$ is the length of circuit *i* taken from ComEd's database; and $observed\_primary\_length_i$ is the length of circuit *i* observed during the field review. The expansion of poles with primary voltage wire additionally accounts for pole subsampling in the field observations. The field observations specified a random start pole between 1 and 10 (1 being the first pole in the observation path). After the start pole, data was collected on every tenth pole in the path of the observations. Additionally, data on the first pole along the observation path was collected for each circuit. The pole expansion calculation therefore incorporates the pole sampling rates.

Stage 2: Expanding Circuit Sample Data to the Circuit Population

The second stage is determined by the circuit sample design, using mean per unit expansion. The estimate of the population mean per unit is:

$$\bar{y} = \sum_h W_h \bar{y}_h$$

where $W_h = N_h / N$ is the stratum weight; N_h is the number of circuits in the population for stratum *h*; *N* is the total number of circuits in the population; and $\bar{y}_h$ is the mean of the expanded circuit-level data over the circuits for stratum *h*. The quantity estimates (e.g., of the amounts of WRW at primary and secondary voltages) are then $\hat{y} = N\bar{y}$.

[14] However, the field team did not find any ComEd-owned secondary conduit during the field inspections.

These estimates are then used to construct ratio estimators for the proportions of interest (e.g., the share of WRW allocated to the secondary voltage level).

2.4 Findings

The allocations for each facility type that result from the methodologies contained in Sections 2.1 through 2.3 are described below.

Underground conduit outside the City of Chicago
The field review found no underground conduit in use at the secondary voltage level. This is consistent with ComEd's original research presented in Docket No. 10-0467. As Mr. Alongi described in his supplemental direct testimony, underground conduit outside the City of Chicago was allocated to secondary costs based on a manual review of its maps.[15] ComEd has subsequently described to the project team that it is aware of only a few locations in which ComEd has used underground conduit in secondary voltage applications, which were included in its original analysis. The field review confirms ComEd's assertion that it does not use underground conduit for secondary voltage lines outside of these instances. Therefore, the project team retains ComEd's original allocation of 1 percent of these costs (underground conduit outside the City of Chicago) to secondary voltage distribution.

Weather-resistant wire
The WRW is contained entirely within FERC account 365, overhead conductors and devices. The field review found the following allocation of WRW costs:

- 22.4 percent to secondary distribution costs;
- 1.0 percent to secondary transformer costs; and
- 76.6 percent to shared (primary) distribution costs.

The results find a substantially higher proportion of shared costs than ComEd assumed in Docket No. 10-0467, in which it allocated 30 percent of weather-resistant wire to shared distribution costs. Mr. Alongi described the basis for ComEd's estimate in his supplemental direct testimony in Docket No. 10-0467:

> ComEd does not have a reasonable way to estimate how many feet of wire it may have installed for such use because ComEd has not installed open wire secondary for more than 20 years. Further, ComEd does not distinguish weather resistant wire from bare wire on its maps of primary voltage circuits.[16]

Given the level uncertainty expressed by Mr. Alongi, it may not be surprising that the field review found a very different proportion of shared costs.

Poles that carry both primary and secondary equipment
ComEd has four categories of cost assignments in their distribution cost of service (COS) study: shared, secondary voltage distribution, secondary voltage transformer, and primary

[15] Docket No. 10-0467, ComEd Exhibit 21.0 Revised, page 25.
[16] *Ibid.*, page 26.

voltage transformer. Pole costs must be assigned to these categories within the COS study.

Shared costs within the COS study are associated with distribution equipment used at primary service level. All primary and secondary voltage customers are allocated a portion of shared cost in the COS study. The reason that secondary voltage customers are rightfully allocated a portion of shared costs is that their load first went through the primary voltage service level before being delivered to them at the secondary voltage service level. This handling of shared costs coincides with traditional utility practice.

For poles that carry both primary and secondary lines ("combination poles"), ComEd allocated 50 percent as secondary costs and 50 percent as primary, or shared costs. Staff asserted that direct observation could help refine this assumption. CA Energy Consulting has a different perspective, which is that direct observation can provide necessary information regarding the number of combination poles in ComEd's system, but it cannot provide information regarding how the costs of such poles ought to be allocated. CA Energy Consulting's recommendation is to remove the 50/50 split of combination pole costs across secondary and primary voltage services and instead allocate 100 percent of combination pole costs as shared costs (i.e., associated with primary voltage service).

The reasoning behind this recommendation is that the combination pole exists to accommodate primary lines first and foremost. The attachment of secondary lines is a convenience for secondary service. If, for example, secondary customers asked that their voltage level of service be changed from secondary voltage to primary voltage, the pole requirement would not change. However, the utility would not be able to transmit power efficiently if it did not have the primary service level at the pole's location (i.e. a utility cannot have secondary service without primary service).

In addition, the height and class of the pole is dictated by the primary service requirements, and not the secondary service requirements. To hang additional secondary lines from the pole generally does not require additional pole cost. The pole height is generally determined by clearances for primary voltage wire and space requirements for cable TV/telephone facilities. The project team confirmed this industry practice with ComEd engineering.

Poles 50 feet or lower in height
In Docket No. 10-0467, ComEd assumed that poles 50 feet and lower in height are allocated 74.2 percent to shared costs. The field review found the following distribution of costs:

- 5.0 percent to secondary distribution costs;
- 2.2 percent to secondary transformer costs; and
- 92.8 percent to shared (primary) distribution costs.

Note that the higher proportion of shared costs is in large part due to the change in the allocation of poles with both secondary and primary equipment described above. If we had maintained ComEd's assumption of a 50/50 allocation for combination poles, the field review would have resulted in an allocation of 70.1 percent of poles 50 feet or lower to shared costs.

Poles taller than 50 feet in height

In Docket No. 10-0467, ComEd assumed that poles taller than 50 feet in height are allocated 82.5 percent to shared costs. The field review found the following distribution of costs:

- 0.0 percent to secondary distribution costs;
- 2.5 percent to secondary transformer costs; and
- 97.5 percent to shared (primary) distribution costs.

As was the case with shorter poles, the higher proportion of shared costs is due in part to the change in the allocation of poles with both secondary and primary equipment. If we had maintained ComEd's 50/50 assumption, the field review would have resulted in an allocation of 87.8 percent to shared costs.

3. Separating Costs into 4kV and Above 4kV Primary Voltage Categories

This section contains a description of the methods used to allocate the shared[17] primary voltage plant in service costs between 4kV primary voltage and above 4kV primary voltage cost categories. Specifically, ComEd is required to "study, define, and delete from the costs assigned to the Railroad Class the costs that are associated with the 4kV facilities that are not used to serve the Railroad Class."[18]

To address this requirement, the project team reviewed each cost item with primary voltage “shared costs” contained in ComEd's Primary / Secondary Study for 2010 costs, prepared in the same manner as the 2009 costs presented in ComEd Exhibit 49.4 in Docket No. 10-0467 to allocate costs between secondary voltage distribution , 4kV primary voltage, and above 4kV primary voltage cost categories. Except for cases in which the results of direct observation are used (as described in Section 2), the project team accepts the assignment of costs categorized as secondary voltage distribution costs from the 2010 Order, and focuses on dividing primary (or "shared") costs into the 4kV and above 4kV cost categories.

3.1 Methodology

In order to divide the shared distribution costs into two categories, the project team examined each cost item found in each of the relevant FERC accounts:

1. 361, structures and improvements;
2. 362, station equipment;
3. 364, poles, towers, and fixtures;
4. 365, overhead conductors and devices;
5. 366, underground conduit; and

[17] Primary voltage plant in service costs shared by customers with primary voltage service points and by customers with secondary voltage service points
[18] Final Order, Docket No. 10-0467, page 191.

6. 367 underground conductors and devices.[19]

The project team accepted the allocation of costs to the secondary function from ComEd's Primary / Secondary Study (with the exception of the items subject to direct observation described in Section 2) and allocated primary voltage "shared" costs to 4kV and above 4kV cost categories using one of the following allocators:

- Direct Assignment (DA): used where the description of the equipment contains the associated voltage level of service, or where the equipment is associated with a specific feeder with a known voltage level.
- Line-mile Ratio (LR): used where DA is not feasible. This is the most commonly used allocation method in the study described here, and is described in detail below. The LR allocator consists of two numbers: the percentages of total circuit miles that are associated with 4kV circuits and above 4kV circuits, respectively.

As described above, a key component of the methodology involved determining the ratio of the circuit lengths operating at 4kV as compared to the circuits operating at above 4kV, including the circuits operating at 12kV and 34kV. The ComEd distribution circuit construction standards are similar in design regardless of voltage, and utilize typical hardware and wood products. While differences exist in the voltage classifications for the insulating equipment on the systems, in general items such as cross-arms, arresters, line switches, fuse cut-outs, protective devices, poles, etc. are installed with similar uniformity regardless of voltage. Since many of these common distribution items in the FERC accounts are not voltage specific, allocating those items into the two voltage categories can be accomplished by using the LR allocator as the allocation factor. With the total circuit lengths determined for the circuits operating at 4kV and the circuits operating at primary voltages greater than 4kV, these ratios can be used to segment the shared portion of the FERC account allocations to the costs associated with these two categories.

In addition, a number of the items in the FERC accounts 361 (structures) and 362 (other) are installed in distribution substations throughout the distribution system to provide service and support to the overall distribution infrastructure. In many cases, these items are not directly supporting a specific voltage classification, but may support several distribution voltages, as in the case of circuits that contain both 4kV and 12kV facilities. Battery chargers, control houses, fencing, protective relays, foundations, steel structures, and similar items required in the construction and the normal operation of distribution substations are not distribution voltage specific. The LR allocator is used to allocate the shared portion of these accounts as well. Where equipment in the accounts are voltage specific, as in the case of 12kV or 4kV switches, these items are directly assigned to the relevant voltage category.

ComEd provided a spreadsheet that contains the circuit length data by phase configuration, detailed by overhead and underground, on each of the ComEd circuits

[19] The project team did not review FERC account 368 (circuit transformers) because its costs are allocated entirely to transformers.

along with operating voltage, station type and other relevant data. A sample of the database is shown below.

Table 3.1 Sample of ComEd's Circuit Database

Circuit ID	1 Phase Miles Over-head	2 Phase Miles Over-head	3 Phase Miles Over-head	1 Phase Miles Under-ground	2 Phase Miles Under-ground	3 Phase Miles Under-ground	Operating Voltage	Station Type	Operating Number
1	0.103	0.274	0.731	0	0	0.348	4KV	TSS	31-4KV
2	0.238	0.494	0.650	0	0	0.963	4KV	TSS	31-4KV
3	0	0.088	1.236	0	0	0.267	4KV	TSS	31-4KV
4	0.304	0.291	0.303	0	0	1.367	4KV	TSS	32-4KV

The spreadsheet contains the circuit length data for the 5,556 active ComEd distribution circuits. The operating voltage for each distribution circuit is identified as 4kV, 12kV, 34kV, 69kV, (12kV & 4kV), or (12kV, 4kV). With this spreadsheet, total circuit lengths can be determined for each of the distribution operating voltages; however the combined 12kV and 4kV circuits are not segregated by voltage, requiring an analysis of these circuits to determine their contribution to circuit lengths for the 4kV and the 12kV totals.

There are 823 circuits identified on the spreadsheet as combinations of 12kV and 4kV facilities. As shown in Section 2, above, a stratified random sample of 32 of these circuits was included the field reviews. The 4kV portions of these circuits were measured from the ComEd operating maps and subtracted from the individual total circuit lengths in ComEd's circuit database to determine the 12kV lengths. The results of these circuit measurements were then expanded based on the statistical selection process as described in Section 3 (Stage 2[20]). The resulting shares were then applied to the entire population of the combined circuits to determine the total lengths of the 4kV circuits and the 12kV circuits for the 823 combined circuits.

The allocation of the combined (4kV and 12kV) circuits was included with the remainder of the circuit database to obtain the overall percentage of the 4kV circuits and above 4kV circuits, identified as the LR (Line Ratio) allocator.

This ratio is used to allocate the shared costs portion of the individual FERC accounts for those distribution items not specified with a voltage designation. As discussed above, where an item is specified by voltage, for example a 12kV switch, then those items are assigned 100% to the relevant voltage. For those line items without a specific voltage designation, such as arrestors, for example, those items are allocated using the LR allocator.

3.2 Findings

The LR allocator that resulted from the methods described in Section 3.1 allocates 5.9 percent of shared costs to 4kV costs and 94.1 percent to above 4kV costs. This allocation method is used for the majority of items (accounting for 95 to 100 percent of shared costs, depending on the FERC account) that have shared costs in FERC accounts 361,

[20] The Stage 1 expansion was not necessary since the entire primary circuit length was considered in the measurements for the sampled circuits.

362, 364, 365, and 366. The remainder of the shared costs in these accounts is directly assigned to a voltage category based on the description of the equipment or its location.

FERC account 367 is somewhat different from the other accounts, in that the majority of the shared costs (nearly 90 percent) are directly assigned based on a description of the equipment.

3.3 Determination of Facilities Used by Extra Large Load Customers

The 2010 Order requires ComEd "to study, define, and delete from the costs assigned to the Railroad Class the costs that are associated with the 4kV facilities that are not used to serve the Railroad Class" and to "perform an investigation of the Extra Large Load customer classes. Included in that study shall be an assessment as to whether these customers use 4kV service".[21]

Although ComEd presented evidence in the 2010 rate case that suggested 4kV may be used or at one time had been used to serve the railroads at one or two of the railroad traction power substation locations, through discussions conducted as part of the efforts described in this report, ComEd and ICC Staff agreed that the Railroad Class would not be allocated any 4kV primary voltage costs. However, analysis was required to determine the extent to which the ELL customers should be allocated 4kV primary voltage costs. This sub-section describes how the project team determined which ELL meter points are served using 4kV primary voltage distribution facilities.

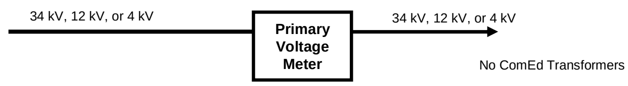
Extra Large Load customers take service from ComEd in a variety of ways. All are served through multiple meter points at various voltages, both primary and secondary, throughout the system. The number of meter points for individual ELL accounts ranges from as few as two locations to as many as 263, with a total of number of meter points presently at 1,820 locations (excluding 10 outflow meters). In order to properly allocate the cost to serve into the four cost categories (secondary voltage distribution, secondary voltage transformer, primary voltage transformer, and shared distribution), each metering point is evaluated individually to determine the service voltage category. Primary and secondary voltage transformer costs are directly allocated and do not require additional analysis. The allocation of ELL meter points to secondary voltage and to primary voltage at 4kV or less and greater than 4kV required the additional analysis described herein.

ComEd provided data on the metering configuration for each ELL metering point. Each of the meter configurations is analyzed to determine service delivery voltage and the source voltage providing that service. The four main primary metering categories are shown in Figure 3.1. A fifth category, not shown in Figure 3.1, is the typical secondary meter set with ComEd-owned transformers providing the secondary voltage (<600V). Meter points belonging to this fifth category are assigned directly to secondary.

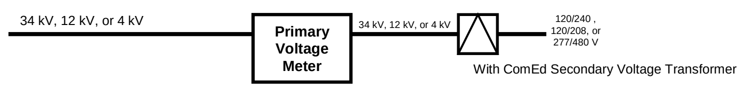
[21] Final Order, Docket No. 10-0467, page 191.

Figure 3.1 Methods for Assigning Meter Points to Voltage Levels

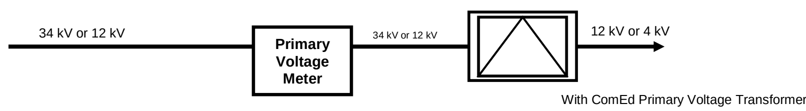
Note: Primary Voltage means >= 4 kV (and < 69 kV), Secondary Voltage means < 4 kV, High Voltage means >= 69 kV



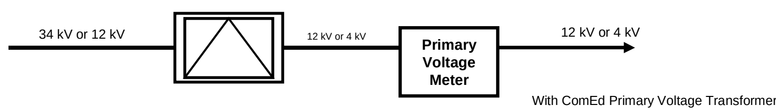
(1) – Primary Voltage Meter No ComEd Transformer



(2) – Primary Voltage Meter With ComEd Secondary Voltage Transformer



(3) – Primary Voltage Meter High Side With ComEd Primary Voltage Transformer



(4) – Primary Voltage Meter Low Side With ComEd Primary Voltage Transformer

To determine how each of the four primary meter categories is allocated to secondary or primary, the actual service voltage was examined. Where the metering point is on the primary line and no ComEd-owned transformers are installed (Category 1), the meter is assigned directly to primary at either 4kV or >4kV depending on the delivery voltage. If the service voltage is secondary (<600V), as in Category 2, the meter is assigned to secondary. Category 3 and 4 meter locations take service at either 4kV or 12kV, however the primary voltage to the ComEd-owned transformer providing the service is at 12kV or 34kV, and so these two categories are assigned directly to primary >4kV. The following text summarizes the description of the assignments of meter points to voltage categories.

1. Primary Voltage Meter, No ComEd Transformer
    a. Service could be provided at primary service of 4kV, 12kV, or 34kV
    b. Meter assigned to primary either 4kV or >4kV depending on service level
2. Primary Voltage Meter with ComEd Secondary Voltage Transformer
    a. Service is provided at secondary voltage levels of less than 600V
    b. Meter assigned to secondary
3. Primary Voltage Meter High Side with ComEd Primary Voltage Transformer
    a. Service is provided to primary voltage either 4kV or 12kV

   b. Meter is assigned to >4kV as the location is provided high side service from 12kV or 34kV
4. Primary Voltage Meter Low Side with ComEd Primary Voltage Transformer
   a. Service is provided at primary voltage either 4kV or 12kV
   b. Meter is assigned to >4kV as the location is provided high side service from 12kV or 34kV

Table 3.2 shows the overall results of the assignment analysis.

Table 3.2 Number of ELL Meter Points by Voltage Level

Voltage Level	Number of ELL Meter Points
Secondary	1,580
Primary at 4 kV or below	6
Primary above 4 kV	234

The meter-by-meter assignments of ELL customers to voltage categories were delivered to ComEd, which used the results to develop the cost-of-service allocation factors for an illustrative embedded cost of service study that does not assign certain costs to ELL customer loads delivered at voltages above 4 kV.

Use of CP or NCP Allocator for Extra Large Load Customers
As part of the "Commission Analysis and Conclusions" relating to ELL customers, the 2010 Order contains the following passage relating to specific allocators (italics added):

> As is set forth in the issue below, the Commission concludes that ComEd must perform an investigation of the Extra Large Load customer classes. Included in that study shall be an assessment as to whether these customers use 4 kV service, and if so, to what extent, *and also whether the NCP or CP allocator is an accurate allocator for these customers.*[22]

The italicized portion may be interpreted in one of two ways: (1) whether the application of either an NCP or CP allocator to all primary voltage distribution costs accurately reflects ELL customers' use of the 4kV distribution; or (2) a comparison of the NCP and CP allocators to determine which of the two more accurately reflects the usage patterns of the ELL customer class. REACT's initial brief appears to provide the source of this portion of the Order, and indicates that the first interpretation is correct.

> [O]nly 0.7% of the capacity of the distribution system assets serving those 45 customers -- a good and reasonable proxy for the class's actual demand -- relies on the 4 kV system. This completely undermines ComEd's proposed ECOSS-based methodology, which allocates these costs based on allocators related to class CP or NCP.[23]

[22] *Ibid.*, page 191.
[23] REACT initial brief, Docket No. 10-0467, page 29.

In its brief, REACT is arguing against the use of either a CP or NCP allocator for 4kV distribution costs on the basis that a very low share of ELL customer load uses that portion of the system. The present report comports with this interpretation of the 2010 Order, in that the project team has separated 4kV primary distribution costs from the above 4kV primary distribution costs and the project team has provided ComEd with the information required to allocate each category of costs appropriately according the respective load shares of the ELL customers (as described earlier in this section). That is, in order to obtain a more accurate representation of what rate classes should be assigned cost responsibility for the 4kV distribution facilities, the following steps were taken:

1. Divide ComEd's primary voltage distribution system into subcategories of equipment greater than 4kV and less than or equal to 4kV.
2. Allocate these two subcategories in the COS study based upon the use of each portion of the primary voltage distribution system. ELL customers are allocated a portion of the 4kV primary voltage distribution system based upon the extent to which their loads contribute to the allocator for this new subcategory.

An alternative interpretation of the requirement to determine "whether the NCP or CP allocator is an accurate allocator for these customers" is to compare the NCP allocator to the CP allocator and determine which of the two is more appropriate. While the project team does not believe that this is the correct interpretation of that requirement, some discussion of it is provided below to clarify why this is not interpreted to be the Commission's intent.

There is variation in the use of CP and NCP allocators for distribution service costs across utilities. The utility survey conducted by CA Energy Consulting[24] did not find a uniformly agreed-upon standard for the use of either method. Ideally, the selection of a CP or NCP allocator would consider how the distribution equipment and system is planned and sized. That is, the distribution engineer ensures that sufficient conductor and transformer capacity is available to meet the local area loads (i.e., equipment peak for each piece of distribution equipment), and the cost allocation method should be consistent with the system planning method. This concept is confirmed in the National Association of Regulatory Utility Commissioners (NARUC) Electric Utility Cost Allocation Manual.

An examination of the ECOSS allocators for the different voltage service levels is informative and relevant to the question at hand as to whether ELL customers are allocated costs accurately using CP or NCP. In ComEd Ex. 10.1, Schedule 2b, page 2 of 4, the CP and NCP allocators for ELL customers at 69 kV and below are quite similar, with both shares at approximately 3 percent. A similarly close result occurs for the CP and NCP allocators at secondary voltage, with both allocators equal to approximately 1.4 percent. Therefore, it appears that ELL is largely unaffected by the choice of a CP or NCP allocator.

[24] Christensen Associates Energy Consulting, *Survey of Approaches to Distribution Cost Allocation by Voltage*, report to ComEd, October 2011.

4. Representativeness of ComEd's Sample of Circuits

In Docket No. 10-0467, ComEd used a sample of four primary voltage circuits (in ComEd Exhibit 21.6) to illustrate its contention that circuits serve a variety of customer types with both underground and overhead facilities, making it both difficult and inappropriate to determine which specific distribution facilities serve particular customer groups. This section addresses a requirement in the 2010 Order for an investigation of the representativeness of the sample of four circuits used by ComEd.

CA Energy Consulting compared the stratified random sample of ComEd circuits developed for the direct observations of poles, underground conduit, and WRW (described in Section 2.1) to the four circuits presented in ComEd Exhibit 21.6 in Docket No. 10-0467.[25] CA Energy Consulting computed average miles overhead and underground, and average customer counts by rate class. Separate estimates were computed for circuits inside the City of Chicago and for “shorter” and “longer” circuit strata outside Chicago.[26]

The circuit characteristics from the stratified random sample for the direct observations are shown in Table 4.1. The sample-based averages differ from the data contained in Exhibit 21.6 in some ways. Notably, the four ComEd Exhibit 21.6 circuits show smaller fractions of underground facilities and higher customer counts than the nearest comparable sample-based averages. However, the random sample summarized in Table 4.1 provides generally similar results to ComEd Exhibit 21.6 in the mix of customers by rate class. Most of the sampled circuits (163 out of 167) have both overhead and underground facilities. Also, most sampled circuits (152 out of 167) have meter points in both residential and nonresidential classes,[27] and all 167 sampled circuits have customers in multiple delivery classes. Primary customers are present on 35 sampled circuits.

While the selection of circuits in ComEd Exhibit 21.6 is not adequate to provide unbiased estimates of average lengths of facilities or customer counts per feeder, it does a relatively good job of representing the typical facility and customer mix conditions that a statistically valid random sample of ComEd circuits shows. Therefore, while ComEd's sample of four circuits is not large enough to provide a statistically valid sample, the conclusions ComEd reached from ComEd Exhibit 21.6 are supported by the statistically valid sample drawn by the project team. Specifically, it is the case that circuits tend to "deliver electricity across both overhead and underground facilities in its primary distribution system and serve a diverse group of customers that includes secondary

[25] This sample comprises the intended random sample for strata 1 and 2 of bin 31 (12 kV feeders outside the City of Chicago), and the actual random sample used for the direct observations for all other strata. The resulting total sample size is 167 circuits.
[26] ComEd Exhibit 21.6 identifies the three circuits outside the City of Chicago as “suburban” in two cases and “rural” for the third. We determined that there was no simple method for assigning circuits outside the City of Chicago to “suburban” and “rural” categories in bulk.
[27] All but one of the sampled circuits without residential meter points have an indicated operating voltage of 34 kV. As a general matter, the circuits in ComEd Exhibit 21.6 are less typical of circuits operating above 12 kV.

voltage residential, nonresidential, and lighting customers, in addition to serving primary voltage nonresidential customers and railroad traction power substations."[28]

In addition, the statistically valid sample drawn by the project team serves as the basis for allocating distribution equipment for which assumptions had previously been used (see Section 2) and to determine the share of 4kV line on circuits labeled by ComEd as "4kV and 12kV" (for purposes of developing the line-mile allocator used in separating shared costs into 4kV and above 4kV primary voltage cost categories, as described in Section 3).

The project team addressed the larger concern regarding determining the distribution facilities used to serve specific customer groups by dividing shared distribution costs into 4kV and above 4kV voltage categories and allocating each according to the class-level usage shares for the Railroad and ELL customer classes, as described in Section 3.[29]

[28] Docket No. 10-0467, ComEd Exhibit 21.0 Revised, page 30.
[29] Railroad class customers are not allocated any 4kV shared distribution costs.

Table 4.1 Selected Characteristics for Sample of ComEd Circuits for Direct Observations

			Average Number of Meter Points by Class											
Location Category	Miles Overhead	Miles Under-ground	Residential Single Family	Residential Multifamily	Watt-Hour	Small Load	Medium Load	Large Load	Very Large Load	High Voltage	Railroad	Dusk to Dawn	Gen Lighting	Primary
City of Chicago (n=38)	2.16	2.36	402	694	26	73	8	3	1	0	0	0	0	0
Suburban/Rural Short (n=36)	4.15	3.19	334	150	13	44	8	3	2	0	0	0	1	1
Suburban/Rural Long (n=93)	17.70	11.43	833	182	23	70	9	2	1	0	0	0	1	1

Unmetered Nonresidential, Dusk to Dawn Lighting, and General Lighting locations are not included in the table

5. Treatment of Rider NS Facilities in Cost of Service

In the 2010 Order, the ICC ordered an investigation of the facilities used to serve ComEd's Extra Large Load customers.[30,31] The ELL customers typically require distribution facilities in addition to or different from the standard installation for their load. The incremental cost of these facilities is billed to the customer through Rider NS – Nonstandard Services and Facilities ("Rider NS").

In that docket proceeding, REACT witness Mr. Terhune raised the possibility that costs of Rider NS facilities are being double- billed.[32] Theoretically, this could occur if customers paying directly for the costs of their own individual nonstandard services are in a delivery class whose customers are allocated a portion of the costs of nonstandard service. Mr. Terhune alleged that this is occurring at ComEd. This rate case issue raised the question as to whether such cost allocation is occurring and, if so, to what extent.

In its order, the ICC expressed an interest in developing an informed position on this question, stating that, "This is a unique situation that warrants further analysis and investigations."[33] This section contains CA Energy Consulting's analysis of ComEd's handling of Rider NS costs and revenues related to the ELL customers.[34]

The analysis of circuit voltage level provided in Section 3 of this report represents a review of the off-property assets used to serve ELL customers. The on-property assets provided to ELL customers are listed in detail in each Rider NS rental calculation which is provided to the customer at the time any facilities are added or revised. The accuracy of these documents was not reviewed because each ELL customer has the opportunity to review the documents, ask for clarification, and dispute any inaccuracy with their rental amount.

Having determined the further review of the Rider NS rental calculations and assets listed in the rentals is not necessary as described above, the purpose of this review is to document ComEd's approach in recovering costs under Rider NS, to compare it with industry practice, and to identify its impacts on costs allocated to ComEd's delivery classes and the revenues that recover these costs. Specifically, the review seeks to determine whether ComEd's cost recovery mechanism includes the opportunity for double recovery of any nonstandard service costs.

5.1 Description of Nonstandard Service

Utilities typically offer a standard level of distribution equipment and service that accommodates most customers' needs. However, on occasion some customers, especially

[30] Extra Large Load customers are customers to which the Extra Large Load delivery class is applicable, as described in ComEd's General Terms and Conditions on Original Sheet No. 137. ELL customers generally are customers that have a billing demand greater than 10,000 kW and receive service at voltages less than 69kV.
[31] Final Order for Docket No. 10-0467, page 195.
[32] ICC Docket No. 10-0467, Direct Testimony of Mr. Harry L. Terhune, on behalf of the Coalition to Request Equitable Allocation of Costs Together, REACT Exhibit 3.0, p. 7, lines 141-153, and on p.23ff.
[33] Final Order for Docket No. 10-0467, page 195.
[34] Note that this review does not include a validation of the rental fee charges against the costs of the non-standard equipment.

large load customers, need special equipment to meet their needs. For example, a hospital may need a higher-than-standard level of reliability and may therefore request redundant transformers and/or dual distribution feeders. When requested and feasible, utilities will provide this extra, nonstandard level of service and equipment. In order to comply with a fairness principle for both the customer requesting nonstandard service and other customers who merely require standard service, the requesting customer is expected to pay the incremental cost of this nonstandard service.

5.2 Rider NS

Rider NS allows ComEd to secure revenues from customers obtaining nonstandard service sufficient to cover the incremental costs of the nonstandard service. Customers are required to prepay the installed incremental cost or pay a monthly incremental (rental) fee, or a combination of the two, depending on the nature of the nonstandard service. The rider sets out in detail requests or requirements that constitute nonstandard service and the circumstances in which they will be provided (technical feasibility and absence of adverse system impact). The rider also allows for cost sharing with other customers benefiting from the nonstandard service, if applicable, and provides formulas for development of fees and rental costs.[35] These formulas, found in Sheet No. 280 of ComEd's Schedule of Rates (ILL. C.C. No. 10), are predicated upon the concept of full recovery, presuming that annual carrying charge rates fulfill their role of spreading full costs over time.

5.3 ComEd's Treatment of Rider NS in its COS Studies

5.3.1 Revenues

Under Rider NS, ComEd determines the incremental cost of the requested nonstandard service above that otherwise required to provide standard service. If the equipment used in providing the nonstandard service is considered not to be reusable (e.g., conductors), the customer prepays the installed incremental cost. ComEd treats this payment as a Contribution in Aid of Construction (CIAC). For equipment used in providing nonstandard service considered reusable (e.g., transformers), the customer pays a monthly rental fee to cover these incremental costs. Thus, both the CIAC and the monthly rental components are designed to ensure that there should be no incremental nonstandard service costs that are charged to other customers.

The use of CIAC is an established and reasonable way of recovering incremental nonstandard service costs. For cost-of-service ("COS") purposes, the utility records investment in new plant equal to the gross investment cost net of the CIAC payment by the customer. This entry is equivalent to the change in gross investment for a new standard service installation for the customer. From the perspective of the rate base/revenue requirement within COS, other customers are indifferent between the addition of customers who pay CIAC for nonstandard service and customers who take standard service.

In the case where the customer pays a monthly rental fee, ComEd subtracts this additional revenue from the cost of the equipment in its embedded cost-of-service studies ("ECOSS"). That is, the revenue requirements/costs for ECOSS purposes are lowered for that test year by the rental revenues. Rider NS rental revenues appear in ComEd's ECOSS, ComEd Ex.

[35] ICC No. 10, Original Sheets Nos. 277-280, effective January 15, 2009.

10.1 of the instant proceeding, in the section entitled "LESS REVENUE CREDITS" in Schedule 2a, the Allocation table, lines 160-180. Thus, as long as the monthly rental fee approximates the embedded revenue requirement/cost for the customer's nonstandard facilities that are subject to the rental in the COS cost computation, net of standard costs, there is no significant impact in aggregate for the utility, and no cost impact on other customers.

When rental revenue is appropriate (i.e., the equipment is reusable), the incremental investment cost of the nonstandard service (i.e., the cost above the standard service investment cost) is multiplied by an annual carrying charge rate and converted to a monthly fee that includes an appropriate O&M component. For example, imagine a customer who requests service through two 2,500 kVA 34 kV to 12 kV transformers in a situation in which the standard facilities for this type of service are just one 2,500 kVA 34 kV to 12 kV transformer. The cost of one transformer (i.e., the standard equipment) is already built into ComEd's base rate pricing. Therefore, the difference between the requested equipment and the standard equipment is the cost of the second transformer. The customer then pays for the standard equipment in the base rate pricing for the customer's applicable delivery class and pays an additional rental fee of, say, $100 per month for the incremental cost of the nonstandard equipment (i.e., the second transformer). The design of both the lump sum prepayment (as CIAC) and the monthly rental components are such that the customer is asked to pay the incremental cost so that other customers do not subsidize the request.

ComEd assigns Rider NS rental revenues directly to asset accounts within sub-functions (e.g., Primary Voltage Transformers and Secondary Voltage Transformers sub-functions within the Distribution function) in their COS study. This assignment appears in ComEd's ECOSS, Schedule 1b, lines 154-160. This assignment to sub-function flows to Schedule 1a, showing up as a combination of Rider NS and Rider ML (meter lease) rental revenues on line 275 of the 2010 ECOSS. Total rental revenues for 2010 are $40,830,000, with approximately $28.6 million attributable to Rider NS rental revenues. This revenue crediting process has the effect of lowering the overall revenue requirements of the respective sub-functions. In the Allocation table of ComEd's ECOSS, the costs and credits, including the Rider NS credits, by sub-function are allocated to delivery classes (see Schedule 2a of ComEd's ECOSS). Therefore, the Rider NS revenues accrue to the benefit of the delivery classes being allocated these sub-functions.

5.3.2 Costs

Incremental costs covered under the CIAC arrangement (non-reusable equipment) are credited by the required contribution from the customer such that the net amount goes into ComEd's rate base. This net amount is what non-reusable standard equipment would cost.

For incremental costs covered under the rental fee arrangement (i.e., reusable equipment), ComEd is not able to track directly the corresponding additional cost associated with a nonstandard installation. This cost of nonstandard equipment in aggregate (i.e., the total cost of the nonstandard equipment, not just the incremental portion beyond standard equipment costs) rests within the utility's appropriate FERC accounts and becomes allocated, along with all other costs in the respective FERC account, to customers using this level of service, as determined by the appropriate allocation factors. For example, gross investment in FERC Account 368 can be seen in aggregate in Schedule 1a, line 21, of

ComEd's ECOSS but the portion of Account 368 gross investment that is related to Rider NS rental revenue is not tracked. Therefore, the Rider NS-related costs present in Account 368 will be allocated in the same manner as all other costs in this account. However, as mentioned above, the costs associated with this account will have previously been lowered by the rental revenue assigned to it.

In summary:

- Nonstandard additions to investment for non-reusable equipment with incremental costs paid in full by the customer add to rate base only to the extent of the value of non-reusable standard asset additions.
- Nonstandard additions to investment of reusable equipment are allocated to appropriate FERC accounts. This addition of the total cost of the nonstandard equipment to revenue requirement is offset by rental fees.

5.4 Industry Practice

5.4.1 Cost Recovery Methods

ComEd's practices are examples of conventional COS accounting practices in the industry. These practices are summarized briefly below.

1. **Cost Recovery via Customer Prepayment.** The utility requires a CIAC to cover the incremental cost of the nonstandard facilities. The asset is booked at a value that is net of the CIAC. The customer is charged the actual cost of the equipment installed, net of the cost of standard equipment.
2. **Cost Recovery via Rental Fees.**
    a. Fees and costs are *outside* regulated revenue requirement. In this method, there is no issue of comingling nonstandard costs and revenues with regulated rates and their associated assets and costs. The underlying concept is that the customer can obtain nonstandard equipment from competitive providers in addition to the regulated utility. If the utility provides this service outside of its regulated business, the regulated utility maintains separate accounting for these nonstandard costs and revenues.
    b. Fees and costs are *inside* regulated revenue requirement. In this method, utilities adopt one of several approaches to costing.
        i. The cost of nonstandard equipment is not differentiated in COS. The rental fee revenues are allocated to all rate classes since all rate classes will be allocated a share of the cost of the nonstandard equipment.
        ii. The cost of the nonstandard equipment is separated and allocated to all rate classes in COS. The rental fee revenues are allocated to all rate classes because all rate classes will be allocated a share of the cost of the nonstandard equipment. This enables a better matching of the allocated rental fee revenues with the allocation of the corresponding cost of nonstandard equipment. To the extent that the rental fees are greater than or less than the cost of the nonstandard equipment, all rate classes

will be affected in COS. (This is the same method as b.i., above, except that the cost of non-standard equipment is specifically identified and allocated.)

iii. The rental fee revenues are assigned in COS to the rate class of the customer requiring the nonstandard equipment. The nonstandard cost covered by the rental agreement is separated and assigned to the rate class requiring the nonstandard equipment. To the extent that the rental fees are greater than or less than the cost of the nonstandard equipment, that specific rate class will be affected in COS.

5.4.2 Effects of the Different Methods

The CIAC methodology recovers in advance of installation the full incremental cost of the nonstandard equipment, beyond the cost of standard equipment, from the customer served by this nonstandard equipment. The cost of the implicit standard equipment is recovered through base rates.

The rental fee mechanism likewise has the goal of adequately covering the cost of the nonstandard incremental service and equipment. Performed correctly, over the period of time over which rentals are collected, the net present value (NPV) of the rental fee revenues should equal the NPV of the incremental costs of the service and equipment. By this mechanism, the participant pays the cost imposed upon the utility for the nonstandard equipment. When the rental fee mechanism is included within a regulated utility's ECOSS, a second goal is to prevent or minimize any impact of this rental fee mechanism and corresponding service and equipment upon other customers, including those in other rate classes.

Assuming that Rider NS rental revenues are assigned as credits to the correct COS sub-function, the remaining issue is whether the timing of revenue recovery corresponds acceptably to the timing of changes in ECOSS revenue requirements. In other words, when revenue requirements are determined and rates are set through a rate case, is there any significant difference in the rental revenues and the inherent revenue requirements for that equipment as determined in the ECOSS?

As an illustration, consider a case in which the incremental cost of a certain nonstandard equipment installation is $1,000 in year one. Suppose that there is a rate case in that year and that the cost of equity, depreciation, taxes, and O&M for this $1,000 of rate base addition might be $200. However, the rental revenue for this $1,000 due to the fixed rental rate may be just $100. The remaining $100 becomes part of revenue requirement under the appropriate FERC accounts, and other customers will pay toward this asset. In contrast, in later years, when the rental payment is still $100, the value of the rate base addition will have declined to just $50, due to the impact of depreciation. At this point, other customers will experience reductions in rates that offset previous increases. Thus, for a single addition of nonstandard, reusable equipment, there may be differences between revenues and costs over the service life of the equipment, even though, under full cost recovery, their net present value is zero.

In reality, there is an ongoing stream of such transactions. Summing across nonstandard rental incomes at various stages of equipment life should produce total revenue contributions that approximately offset the stream of costs. Unless investment is extremely "lumpy", timing mismatches should be tiny. The combination of a smooth stream of nonstandard rental transactions, regular rate cases and the relatively small amount of nonstandard rental income suggests that timing effects are likely to be quite small and the revenue impacts on customers through standard rates will be trivial and non-systematic.

ComEd's nonstandard rental revenues reflect the industry experience of occupying a small share of electric revenues. Total Rider NS rental revenues amount to roughly $28.6 million in ComEd's ECOSS. The "Total Cost of Service" for ComEd's ECOSS is $2,040 million. (See Schedule 2a, line 249 of ComEd's ECOSS.) Therefore, the Rider NS rental revenues are a small component of the overall cost to serve: approximately 1.4%.

5.4.3 Survey Results

As part of the project to assist ComEd in meeting the requirements of the ICC's Order in Docket No. 10-0467, CA Energy Consulting conducted a survey of utilities regarding distribution costing practices. A question on this survey asked respondents about the methods that they use to handle the additional cost of nonstandard equipment at the distribution level. Results from 16 participants were obtained. Responding utilities represented a variety of utility sizes and urban densities.[36]

Respondents reported using a variety of methods to book revenues and costs, with no single method dominant. Regarding revenues, they uniformly claim to recover the full incremental cost of nonstandard equipment through customer payments. CIAC and fee arrangements are in common use, and a couple of utilities report using a bill premium percentage as an alternative to a fee. Revenues, whether collected via CIAC or fees, are likelier to be attributed to the rate class of the customer seeking nonstandard service than are costs. In contrast, costs are likelier to be given no separate recognition, or allocated in the same manner as all the costs in the specific account category. One utility reported socializing all revenues and costs.

Additionally, several utilities mentioned that the cost levels were simply not significant enough to merit detailed treatment. Thus, their approach was guided more by practicality rather than by accounting theory.

In summary, the survey results offer an indication that ComEd's methods are well within the range of industry practice. In particular, other utilities do not pursue detailed accounting of nonstandard expenses due to their relative insignificance. Instead, they adopt a variety of convenient vehicles for recording expenses and revenues that produce approximate correspondence between revenues and costs. Customers seeking nonstandard service make payments designed to recover fully the incremental cost above standard equipment cost and all customers pay for standard equipment cost through regular payment mechanisms.

5.5 Summary of ComEd's Methods re Nonstandard Service

Based on our review of ComEd's methods, we conclude the following:

[36] Christensen Associates Energy Consulting, *Survey of Approaches to Distribution Cost Allocation by Voltage*, report to ComEd, October 2011; sections 2.2.7, 3.2.7

1. Rider NS revenues reduce cost of service within ComEd's ECOSS that would occur if ComEd did not charge for reusable nonstandard equipment but yet still offered reusable nonstandard equipment to its customers.
2. Rider NS CIAC revenues avoid an increase in the investment cost of equipment in ComEd's ECOSS beyond the cost of non-reusable standard equipment.
3. Rider NS rental revenues are assigned in ComEd's ECOSS to the respective functions from which the related additional reusable equipment resides on a FERC account basis. These rental revenues become credits to reduce the costs that are then allocated to delivery class.
4. For any specific cost-of-service year (e.g. test year), there may be a minor timing mismatch of Rider NS rental revenues (based on carrying charge rates applied to actual reusable equipment costs) and the related embedded costs of the additional reusable equipment covered by Rider NS rental revenues. While this can create a minor aggregate difference between the Rider NS rental revenue total and the ECOSS for a COS test year in aggregate and upon the allocation to delivery class, the magnitude should be small. For any single transaction the timing of rate cases, if widely dispersed, might matter. However, there is a steady stream of such transactions, suggesting that over time, minor timing differences should "wash out" with periodic rate cases. Coupled with the relatively small dollar volume of such transactions, it is easy to see why the surveyed utilities have not made the effort to acquire the capability to study and measure this "timing difference".
5. Due to the segregation of incremental nonstandard service costs from standard costs, only standard costs enter the revenue requirement. Thus, there do not appear to be any significant inter-class subsidies caused by Rider NS. Accordingly the ELL delivery service class does not appear to be double-paying for any component of the nonstandard services that its customers request from ComEd.

5.6 Recommendations

1. ComEd should continue to charge customers for non-reusable, non-standard equipment and record the revenue as CIAC.
2. Rider NS rental revenues that incorporate an annual carrying charge rate to determine rental charges should continue to be used to secure payment for equipment that is reusable.
3. The ECOSS method for treatment of CIAC is sound and should continue.
4. The ECOSS method for treatment of rental revenues and cost is reasonable and it is reasonable to continue this procedure. Tracking the rental revenue equipment cost would possibly be a complex and costly accounting task, and its cost allocation impacts should be quite small.