# 2015 ComEd Distribution System Loss Study

Commonwealth Edison Company

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Summary
An engineering analysis of distribution system losses using 12 months ending December 31, 2015 (Study Period), customer hourly load data, and distribution system equipment information was conducted to determine the Distribution Loss Factors for various customer categories. Distribution losses are determined by subtracting the energy delivered to retail and wholesale customers and transmission energy losses from the ComEd Zone Load plus energy purchased by ComEd from retail customers under Parallel Operation of Retail Customer Generating Facilities, (Rider POG), whose output is not measured within the zone energy. The ComEd Zone Load is the summation of the net output of all generators within the ComEd Zone plus net transmission interchange.

Study Approach
Distribution losses were calculated using a simplified resistance model of the elements that are used to deliver energy from the transmission system to consumers. The calculated losses are used to allocate total distribution losses to each customer category. All abbreviated terms used in the document are described in the Abbreviated Terms section of this study.

Customer Categories
An hourly load profile for each customer category was developed using appropriate sample data, as described in a document with the title “E-7 Load Research Results and Supporting Materials,” submitted in the current ComEd formula rate update proceeding which is similar to the data required in a general rate case filing pursuant to Section 285.5120 of 83 Illinois Administrative Code Part 285, the standard information requirements for public utilities. Each profile represents electricity deliveries to a category of customers during the Study Period. The categories are used to represent the delivery classes defined in ComEd’s General Terms and Conditions and to wholesale resale municipalities. In some cases, the customer categories used for the loss factor analysis are identical to the delivery classes in General Terms and Conditions. In other cases, the loss category is comprised of customers that receive service using similar distribution system facilities. Some of the delivery classes are comprised of more than one loss study customer category. Electricity deliveries to all ComEd retail customers (i.e., those taking ComEd bundled service as well as those taking delivery service from ComEd and unbundled supply service either from a Retail Electric Supplier or from ComEd under Rate BES – Basic Electric Service or Rate BESH – Basic Electric Service Hourly) are included in the load profiles by customer category. A description of the customer categories used for this distribution loss factor determination is listed in Appendix A. Hourly loads for each applicable customer category were increased to include service provided without charge (also known as free service) and ComEd company use in that customer category. The load for the high voltage customer category in this distribution loss factor determination is for the portion of the customer load receiving service at 69 kV or higher voltage excluding the loads

metered at 138kV or higher where there are no step-down transformers between the transmission system and the meter location. There are no material distribution energy losses for this type of load. In addition, the load for the D-D Lighting category in this study includes loads for both the Dusk to Dawn Lighting and the Fixture-Included Lighting Delivery Classes.

Loss Model

The simplified resistance model of the distribution system is used to account for load and no-load losses in loss causing elements. A diagram of the simplified resistance model is shown in Appendix B. An allocation factor for each element defines the portion of the energy for each customer category that flows through that element. Allocation factors were determined from review of the equipment configuration typically used to serve customers of that category. The allocation factors are listed in Appendix C. Utilizing these allocation factors and the customer category loads at the system peak hour for the Study Period (hour ending 5 p.m. on September 3, 2015, which is the 2015 system peak hour), load dependent and non-load dependent losses are calculated for each element. Per unit load and no-load loss factors for each element are based on system average values and are listed in Appendix D. System peak hour losses are determined for each customer category and each element. Peak hour losses and losses as a percent of load for each element are listed in Appendix E.

Element Loss Calculation

Losses in the elements consist of both load losses and no-load losses. Load losses occur in each element and vary with the square of the load ($I^2R$).

Load Losses:

- Feeder and line load loss is calculated as the sum of the allocated category loads squared, multiplied by element percent load loss, all divided by the coincident load.
- Load loss for substation transformers that serve many customers in multiple customer categories (Appendix D, loss code = 1) is calculated as the sum of the loads for all categories squared, multiplied by the element percent load loss, divided by the nameplate MVA of the transformers in that category.
- Load loss for transformers used to serve customers of the same category (Appendix D, loss code = 2) is calculated as the sum for each load category of the category load squared, divided by the total category-coincident load, summation quantity multiplied by the element percent load loss.

No-Load (core) Losses:

- Transformer element no-load loss is calculated from installed MVA of transformer capacity multiplied by the percent core loss for that category of transformer.

Some transformers are located at 138-69, 138-34, 138-12, 69-12, 34-12, 34-4 and 12-4 kV substations. Other transformers are used to reduce primary feeder voltages to the customer delivery voltage. No-load losses are constant at all load levels.

Non-coincident Category Peak Loads

For customer categories with a non-coincident peak significantly different from the load at the system peak hour, the peak load and no-load losses are based on losses for an hour representative of that category. For the dusk to dawn lighting category, the non-coincident peak hour (hour ending 10 p.m. on September 3, 2015) was used. For the residential single family and multi-family electric space heat categories, the average of the load at the 2015 system peak hour and the load at the respective category 2015 winter peak hours on January 8, 2015 and January 7, 2015 were used. The category-to-element allocation factors are used to allocate element losses to category loads to determine the peak hour losses by customer category.

Annual Energy Losses

Hourly load losses for each category for each hour are then calculated using the square of the ratio of the hourly category load for the hour to the category load at the peak hour multiplied by the load loss at the peak hour.

Hourly Load Loss = Peak Load Loss * (Hourly Load/Peak Load) ^2

No-load losses determined for the peak hour remain constant for all hours. The annual loss factor for each category is determined from the ratio of total load and no-load losses for the category to the annual energy deliveries for that category. A summary of losses on an annual basis for each category is listed in Appendix G.

Secondary and Service Losses

Secondary and Service losses were calculated based upon the results of the “ComEd Secondary and Service Loss Study”, ICC Docket 14-0312 ComEd Exhibit 9.02, submitted in the 2014 proceeding, dated April 14, 2014. Secondary and service losses for selected customers in all classes that utilize secondary and service conductors had been calculated using customer annual peak loads and conductor size, type and length information obtained from a field survey of each of the selected customers. Secondary and service losses have not been calculated for the Railroad, HV or Primary service categories since only primary conductors are used to provide service to these customers.

The secondary and service loss as a percent of peak load by customer category is shown in Appendix C. The secondary and service losses are calculated by multiplying the average loss percentage for each category by the class load at peak. The results of this calculation are listed in Appendix E.

Transmission Losses

Annual transmission energy losses were calculated using the results of a study of transmission losses by Siemens PTI dated December 14, 2011. Transmission losses for this distribution loss study were determined using the factor of 2.31% of the Zone

energy per the 2011 study. Transmission system losses in the 2011 study were 1.96% for peak load levels.

Changes from the Previous Loss Study (ICC Docket No. 15-0287 ComEd Ex. 5.01)

- Substation and distribution transformer quantities were updated.

Reconciliation of Peak Hour Losses

The sum of the calculated transmission and distribution losses for all delivery system users plus total energy delivered was compared to the ComEd Zone load plus Rider POG energy at the system coincident peak hour. The calculated load plus losses was 150 MW (approximately 0.74% of the load) more than the ComEd Zone load plus Rider POG energy. The no load (core) and peak hour load (I^2R) losses for each category were proportionally decreased by this amount to fully allocate peak hour losses. Peak hour load (I^2R) and no-load (core) losses and loads by category following this adjustment are listed in Appendix F.

Reconciliation with ComEd Zone Energy for the Study Period

Total distribution energy loss for each category is determined by summing the load and non-load losses for all hours by category. As a final check, category energy deliveries, distribution losses by category and transmission losses were totaled for comparison to the total of ComEd Zone energy plus Rider POG energy for the Study Period. The total energy received was approximately 1.0056 of deliveries plus calculated losses. A final adjustment to distribution losses was applied so that load plus losses equals the ComEd Zone Load plus Rider POG energy. Appendix G contains the total energy delivered and calculated annual distribution energy losses by category.

Abbreviated Terms

| *Abbreviation* | *Description* |
|---|---|
| AC | Alternating Current |
| ACNW | Alternating Current Network |
| DC | Distribution Center |
| DRYTR | Dry Type Transformer |
| ESS | Electric Service Station |
| FDR | Feeder |
| HV | High Voltage |
| kV | Kilovolt |
| kVA | Kilovolt Ampere |
| kW | Kilowatt |
| MVA | Megavolt Ampere |
| SEC | Secondary |
| SERV | Service |
| TDC | Transmission Distribution Center |
| TR, TRANF | Transformer |
| TSS | Transmission Substation |

Appendix A

## System Loss Factors - Customer Categories[1]

| Abbreviation | Description |
|---|---|
| SF | Single Family Without Electric Space Heat |
| MF | Multi Family Without Electric Space Heat |
| SF_SH | Single Family With Electric Space Heat |
| MF_SH | Multi Family With Electric Space Heat |
| WH | Watt-Hour |
| 0-100 kW | Small Load (0 to 100 kW) |
| 100-400 kW | Medium Load (100 to 400 kW) |
| 400-1,000 kW | Large Load (400 to 1,000 kW) |
| 1-10 MW | Very Large Load (1,000 to 10,000 kW)[2] |
| >10 MW | Extra Large Load (Over 10,000 kW)[2] |
| HV > = 69 kV | Receiving service at 69 kV and higher voltage[2] |
| HV DLF=0 | Metered at 138kV and higher with no loss elements between the transmission system and meter location |
| Railroad | Railroad (using electric traction power) |
| D-D Lighting | Dusk to Dawn Lighting and Fixture-Included Lighting |
| Gen Lighting | General Lighting |
| Muni | Wholesale Municipal[3] |
| Primary Voltage | Customers taking delivery at a voltage of 2.4 kV or higher but less than 69 kV |

Notes:

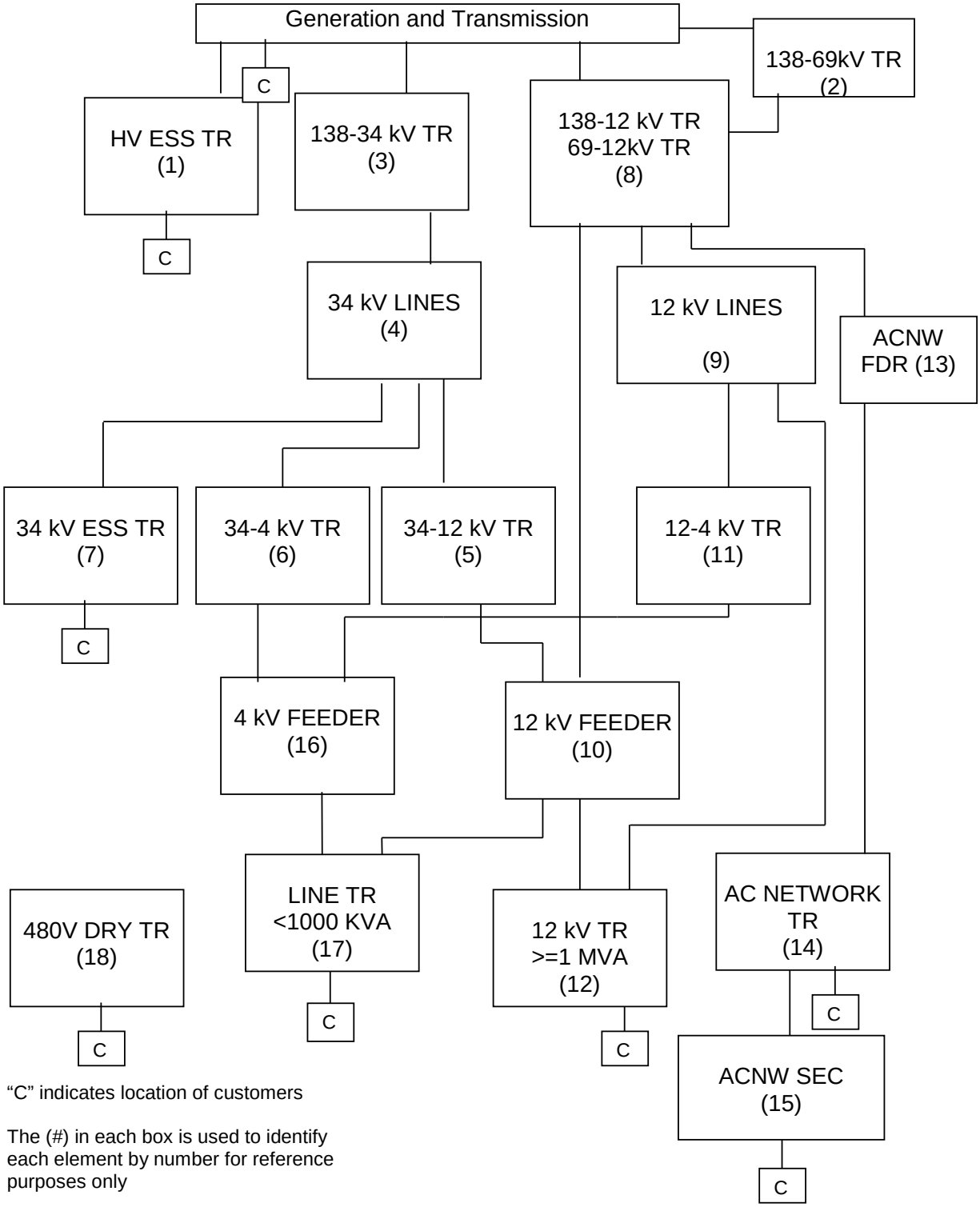
(1) Hourly loads for comparable categories have been increased to account for electricity delivered for:
- Service provided without charge
- ComEd company use

(2) For the determination of distribution losses, the portions of load that are receiving service at voltages below 69 kV but at or above 2.4 kV to customers in the Small Load Delivery Class through the High Voltage Delivery Class are included in the Primary Voltage loss category. The portions of load receiving service at voltages below 2.4 kV to customers with up to 10,000 kW of load and to customers with over 10,000 kW of load in the High Voltage Delivery Class are included in the Very Large Load (1,000 kW to 10,000 kW) and the Extra Large Load loss categories, respectively. The portion that is receiving service at 69 kV and higher voltage to customers in the High Voltage Delivery Class is included in the “HV >= 69 kV” loss category.

(3) Wholesale municipal load include all deliveries to Naperville, St. Charles, Batavia, Geneva, Winnetka, Rock Falls, and Rochelle.

**Loss Factors - Simplified System Resistance Model**

Appendix B




"C" indicates location of customers

The (#) in each box is used to identify each element by number for reference purposes only

Appendix C

## 2015 Loss Factors - Percent of Category Load Through Elements

| Element (#) | Description | SF | MF | SF_SH | MF_SH | WH | 0-100 kW | 100-400 kW | 400-1,000 kW | 1-10 MW | >10 MW | HV >= 69 kV | Railroad | D-D Lighting | Gen Lighting | Muni | Primary Voltage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | HV ESS | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 13 | 0 |
| 2 | 138-69 TSS | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 8 | 5 | 4 | 4 | 0 | 2 |
| 3 | 138-34 TSS | 17 | 16 | 17 | 16 | 17 | 17 | 20 | 20 | 25 | 25 | 0 | 3 | 17 | 17 | 34 | 60 |
| 4 | 34KV LINES | 17 | 16 | 17 | 16 | 17 | 17 | 20 | 20 | 25 | 25 | 0 | 3 | 17 | 17 | 34 | 60 |
| 5 | 34-12KV DC | 13 | 13 | 12 | 13 | 13 | 13 | 10 | 6 | 0 | 0 | 0 | 3 | 13 | 13 | 0 | 0 |
| 6 | 34-4KV DC | 4 | 3 | 5 | 3 | 4 | 4 | 5 | 1 | 0 | 0 | 0 | 0 | 4 | 4 | 0 | 0 |
| 7 | 34KV ESS | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 13 | 25 | 25 | 0 | 0 | 0 | 0 | 5 | 60 |
| 8 | 138/69-12 TDC | 83 | 84 | 83 | 84 | 83 | 83 | 80 | 80 | 75 | 75 | 0 | 97 | 83 | 83 | 0 | 40 |
| 9 | 12KV LINES | 5 | 5 | 5 | 5 | 5 | 7 | 8 | 11 | 35 | 35 | 0 | 85 | 10 | 10 | 0 | 0 |
| 10 | 12KV FDR | 78 | 77 | 78 | 77 | 73 | 71 | 67 | 64 | 40 | 40 | 0 | 12 | 71 | 71 | 0 | 40 |
| 11 | 12-4KV DC | 5 | 5 | 5 | 5 | 5 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 0 | 0 |
| 12 | 12KV ESS | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 25 | 75 | 75 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | ACNW FDR | 0 | 2 | 0 | 2 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 |
| 14 | ACNW TRANF | 0 | 2 | 0 | 2 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 |
| 15 | ACNW SEC | 0 | 2 | 0 | 2 | 5 | 5 | 5 | 5 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 0 |
| 16 | 4KV FDR | 9 | 8 | 10 | 8 | 9 | 9 | 8 | 1 | 0 | 0 | 0 | 0 | 9 | 9 | 0 | 0 |
| 17 | LINE TRANF | 100 | 98 | 100 | 98 | 95 | 95 | 80 | 57 | 0 | 0 | 0 | 0 | 98 | 98 | 0 | 0 |
| 18 | 480V DRYTR | 0 | 10 | 0 | 10 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

## Secondary and Service Losses in Percent of Peak Load by Customer Class

| Class | SF | MF | SF _SH | MF_ SH | WH | 0-100 kW | 100-400 kW | 400-1,000 kW | > 1-10 MW | > 10 MW | HV Load w losses | Railroad | D-D Lighting | Gen Lighting | Muni | Primary Class |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sec % | 0.50 % | 0.26 % | 0.14% | 0.02% | 0.12 % | 0.33% | 0.68% | 0.04% | 0.12% | 0.22% | 0.00% | 0.00% | 0.18% | 0.48% | 0.00% | 0.00% |
| Serv% | 0.31 % | 0.24 % | 0.50% | 0.16% | 0.08 % | 0.20% | 0.54% | 0.10% | 0.10% | 0.23% | 0.00% | 0.00% | 0.44% | 0.09% | 0.00% | 0.00% |
| **Total %** | 0.81 % | 0.50 % | 0.64% | 0.18% | 0.20 % | 0.53% | 1.22% | 0.14% | 0.22% | 0.45% | 0.00% | 0.00% | 0.62% | 0.57% | 0.00% | 0.00% |

## 2015 Loss Factors - Element Loss Parameters

Appendix D

Element losses at nameplate load for transformers or at system peak for lines

| Element | | Core loss% | I^2 R loss% | Base MVA | Loss Code[1] |
|---|---|---|---|---|---|
| (#) | Description | | | | |
| 1 | HV ESS | 0.07 | 0.55 | 3735 | 2 |
| 2 | 138-69 TSS | 0.08 | 0.39 | 2146 | 1 |
| 3 | 138-34 TSS | 0.2 | 0.7 | 6203 | 1 |
| 4 | 34KV LINES | 0 | 3 | 3930 | 1 |
| 5 | 34-12KV DC | 0.2 | 0.8 | 3963 | 1 |
| 6 | 34-4KV DC | 0.3 | 0.8 | 1060 | 1 |
| 7 | 34KV ESS | 0.3 | 0.8 | 3158 | 2 |
| 8 | 138/69-12 TDC | 0.2 | 1 | 22946 | 1 |
| 9 | 12KV LINES | 0 | 2 | 1850 | 1 |
| 10 | 12KV FDR | 0 | 4 | 11668 | 1 |
| 11 | 12-4KV DC | 0.3 | 0.8 | 1141 | 1 |
| 12 | 12KV ESS | 0.3 | 0.8 | 18163 | 2 |
| 13 | ACNW FDR | 0 | 0.8 | 334 | 1 |
| 14 | ACNW TRANF | 0.3 | 1 | 2091 | 1 |
| 15 | ACNW SEC | 0 | 0.5 | 334 | 1 |
| 16 | 4KV FDR | 0 | 5 | 1098 | 1 |
| 17 | LINE TRANF | 0.28 | 1.46 | 33799 | 2 |
| 18 | 480V DRYTR | 0.7 | 1.4 | 567 | 2 |

[1]Loss Code – I^2 R losses proportional to:

1. square of the sum of the load
2. sum of the squares of the load

Appendix E

## 2015 Peak Hour Distribution Model Losses (in MWs, unless otherwise indicated)

| Element | | I^2 R Loss | Core Losses | Total Losses | Allocated Category load | % Loss (load) |
|---|---|---|---|---|---|---|
| (#) | Description | | | | | |
| 1 | HV ESS | 2.3 | 2.6 | 4.9 | 549.2 | 0.89 |
| 2 | 138-69 TSS | 1.0 | 1.7 | 2.7 | 731.5 | 0.37 |
| 3 | 138-34 TSS | 18.8 | 12.4 | 31.2 | 3929.7 | 0.79 |
| 4 | 34KV LINES | 120.0 | 0.0 | 120.0 | 3929.7 | 3.05 |
| 5 | 34-12KV DC | 5.5 | 7.9 | 13.4 | 1649.3 | 0.81 |
| 6 | 34-4KV DC | 2.0 | 3.2 | 5.2 | 518.0 | 1.00 |
| 7 | 34KV ESS | 7.1 | 9.5 | 16.6 | 1570.1 | 1.06 |
| 8 | 138/69-12 TDC | 95.4 | 45.9 | 141.3 | 13852.0 | 1.02 |
| 9 | 12KV LINES | 37.2 | 0.0 | 37.2 | 1850.0 | 2.01 |
| 10 | 12KV FDR | 488.1 | 0.0 | 488.1 | 11668.3 | 4.18 |
| 11 | 12-4KV DC | 2.4 | 3.4 | 5.8 | 580.2 | 1.00 |
| 12 | 12KV ESS | 18.3 | 54.5 | 72.8 | 2429.0 | 3.00 |
| 13 | ACNW FDR | 2.8 | 0.0 | 2.8 | 333.7 | 0.84 |
| 14 | ACNW TRANF | 0.5 | 6.3 | 6.8 | 333.7 | 2.04 |
| 15 | ACNW SEC | 1.7 | 0.0 | 1.7 | 333.7 | 0.50 |
| 16 | 4KV FDR | 54.9 | 0.0 | 54.9 | 1098.2 | 5.00 |
| 17 | LINE TRANF | 169.4 | 94.6 | 264.0 | 12748.0 | 2.07 |
| 18 | 480V DRYTR | 2.2 | 4.0 | 6.2 | 183.5 | 3.35 |

## Secondary and Service Losses (MW) at peak load hour by Customer Class

| Class | SF | MF | SF_SH | MF_SH | WH | 0-100 kW | 100-400 kW | 400-1,000 kW | > 1-10 MW | > 10 MW | HV Load w_losses | Railroad | D-D Lighting | Gen Lighting | Muni | Primary Class | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sec | 31.6 | 2.9 | 0.1 | 0.0 | 0.1 | 8.1 | 13.1 | 0.6 | 2.7 | 0.5 | 0.0 | 0.0 | 0.3 | 0.1 | 0.0 | 0.0 | 59.8 |
| Serv | 19.6 | 2.7 | 0.4 | 0.3 | 0.1 | 4.9 | 10.4 | 1.6 | 2.2 | 0.5 | 0.0 | 0.0 | 0.8 | 0.0 | 0.0 | 0.0 | 42.7 |
| **Total** | 51.2 | 5.6 | 0.5 | 0.3 | 0.1 | 13.1 | 23.4 | 2.3 | 4.9 | 1.0 | 0.0 | 0.0 | 1.2 | 0.1 | 0.0 | 0.0 | 102.6 |

"Losses by Element" is unadjusted for difference between the addition of ComEd Zone Load+ QF Generation and load plus losses. Upstream element loads increased to include losses in downstream elements.

## 2015 Peak Hour Losses by Category, Adjusted to Allocate Zone Peak (MWs)

| Category | SF | MF | SF_SH | MF_SH | WH | 0-100 kW | 100-400 kW | 400-1,000 kW | > 1-10 MW | > 10 MW | HV Load | RR | D-D Lighting (1) | Gen Lighting | Muni | Primary Voltage | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I**2 R Loss D | 405 | 69 | 5 | 11 | 4 | 147 | 122 | 78 | 93 | 10 | 2 | 3 | 11 | 1 | 8 | 40 | 997 |
| Core Losses D | 67 | 14 | 1 | 2 | 1 | 28 | 24 | 22 | 43 | 4 | 2 | 0 | 2 | 0 | 1 | 6 | 219 |
| Total Losses D | 473 | 83 | 6 | 13 | 5 | 176 | 146 | 100 | 136 | 14 | 4 | 3 | 14 | 1 | 9 | 46 | 1216 |
| Load | 6316 | 1119 | 84 | 187 | 72 | 2468 | 1922 | 1608 | 2223 | 223 | 463 | 95 | 0 | 17 | 663 | 1034 | 18493 |
| % Loss D (load) | 7.48 | 7.41 | 7.38 | 7.13 | 6.96 | 7.13 | 7.59 | 6.22 | 6.10 | 6.30 | 0.82 | 2.99 | 0.00 | 7.12 | 1.32 | 4.48 | 6.58 |

| Residual Losses | Zone Load + QF Generation | Category Load | HV DLF=0 | I^2 R Loss | Core Loss | T Loss |
|---|---|---|---|---|---|---|
| 0.0 | 20223 | 18493 | 64 | 997 | 219 | 449 |

## 2015 Adjusted loads and losses for space heating categories (MWs)

| Category | SF_SH (2) | MF_SH (2) |
|---|---|---|
| I**2 R Loss D | 11.4 | 22.7 |
| Core Losses D | 1.9 | 4.9 |
| Total Losses D | 13.3 | 27.6 |
| Load | 180 | 388 |

Notes:
(1) Loads and losses for the D-D Lighting categories are based on the non-coincident peak of the loss category.
(2) Loads and losses for the Space Heating categories are based on the average of the coincident and non-coincident peaks of the loss categories.

## 2015 Annual Energy Loss By Customer Loss Category[1]

| Category | Category Peak | Load Factor | Energy Delivered | D Losses | 2015 Loss Factor |
|---|---|---|---|---|---|
| SF | 6,671 | 0.34 | 19,947,289 | 1,254,625 | 6.29% |
| MF | 1,251 | 0.41 | 4,481,630 | 294,089 | 6.56% |
| SF_SH | 277 | 0.29 | 712,651 | 51,851 | 7.28% |
| MF_SH | 588 | 0.30 | 1,564,414 | 112,354 | 7.18% |
| WH | 90 | 0.52 | 409,421 | 27,001 | 6.59% |
| 0-100 kW[2] | 2,588 | 0.52 | 11,800,153 | 737,461 | 6.25% |
| 100-400 kW[2] | 2,117 | 0.56 | 10,352,278 | 709,658 | 6.86% |
| 400-1,000 kW[2] | 1,724 | 0.60 | 9,111,812 | 548,792 | 6.02% |
| >1-10 MW[(2)(3)] | 2,342 | 0.67 | 13,653,631 | 883,271 | 6.47% |
| >10 MW[(2)(3)] | 243 | 0.71 | 1,503,854 | 99,789 | 6.64% |
| HV >= 69 kV w_losses[(2)(3)] | 643 | 0.78 | 4,366,666 | 40,205 | 0.92% |
| HV DLF=0[3] | 249 | 0.47 | 1,035,132 | 0 | 0.00% |
| Railroad | 142 | 0.41 | 506,296 | 13,555 | 2.68% |
| D-D Lighting | 189 | 0.47 | 782,167 | 71,650 | 9.16% |
| Gen Lighting | 17 | 1.00 | 144,645 | 11,516 | 7.96% |
| Muni | 689 | 0.54 | 3,285,605 | 36,130 | 1.10% |
| Primary Voltage[2] | 1,126 | 0.73 | 7,246,442 | 316,247 | 4.36% |
| Total Deliveries | 18,566 | 0.56 | 90,904,086 | 5,208,192 | 5.73% |

Notes:

(1) As explained in the Customer Categories section of this document, customer categories are not identical to the Delivery Classes in General Terms and Conditions. Hourly loads for comparable categories have been increased to account for energy delivered for:

- Service provided without charge
- ComEd company use

(2) The portions of load that are receiving service at voltages below 69 kV but at or above 2.4 kV to customers in the Small Load Delivery Class through the High Voltage Delivery Class are included in the Primary Voltage category. The portions of load receiving service at voltages below 2.4 kV with up to 10,000 kW of load and to customers with Over 10,000 kW of load in the High Voltage Delivery Class are included in the Very Large (1,000 to 10,000 kW) and Extra Large (Over 10,000 kW) customer categories respectively. The “HV>=69 kV w_Losses” customer category includes the portion of load receiving service at 69 kV or higher voltage to customers in the High Voltage Delivery Class.

(3) The Distribution Loss Factors developed based on the study presented in this exhibit for customers in the High Voltage Delivery Class with loads up to 10,000 kW and customers with loads over 10,000 kW are different than the Distribution Loss Factor for the “HV>=69 kV” customer class shown here is because a portion of the loads delivered to customers in the High Voltage Delivery Class is at voltages below 69 kV. The Distribution Loss Factor for customers with at least a portion of the load metered at or above 138 kV in that delivery class is not 0 because this group of customers also have loads metered at voltages lower than 138 kV.