



**Results of Xcel Energy**  
**Minimum Distribution System & Zero Intercept**  
**Studies**

## 1. Overview

An important step in the Class Cost of Service Study (CCOSS) process is to classify costs according to one of the following billing components based on the nature of the cost:

1. Demand – Costs that are driven by customers’ maximum kilowatt (kW) demand.
2. Energy – Costs that are driven by customers’ energy or kilowatt-hours (kWh) requirements.
3. Customer – Costs that are related to the number of customers served.

For Distribution Plant Investment, costs are classified as being capacity or customer-related. Page 87 of the NARUC Electric Utility Cost Allocation Manual and Table 1 below shows how FERC classifies distribution plant by function and sub-function.

**Table 1**  
**FERC Classification of Distribution Plant Investment**

Function/Sub-Function	Cost Classification	
	Demand	Customer
Distribution Substations	X	
Primary Transformers	X	
Primary Lines	X	X
Secondary Lines	X	X
Secondary Transformers	X	X
Service Drops	X	X

As shown in the table above, primary lines, secondary lines and secondary transformers are classified as both “demand” and “customer” related costs. Costs of these sub-functions are driven by **both** the number of customers on the distribution system and the capacity requirements they place on the system.

The Minimum System and Zero Intercept methods are two widely used methods for determining the percent of distribution plant investment that is customer-related and allocated to class with a customer based allocation factor, versus the percent of costs that are capacity-related and allocated to class with a demand based allocator. These methods are described on pages 86-96 of the NARUC Electric Utility Cost Allocation Manual.

The Company has used the Minimum System method to do this classification for distribution plant investment in its rate cases since the 1990s.

## 2. Steps for Completing a Minimum System Study

The following steps are taken to complete a minimum system study (these steps are also described on pages 90-92 of the NARUC manual):

**Step 1:** Determine the minimum sized conductor, transformer and service that are installed on the distribution system.

**Step 2:** Determine the installed cost per unit for the minimum sized plant. Installed costs include material costs, labor costs and equipment costs.

**Step 3:** Multiply the cost per unit of the minimum sized plant by the total inventory of each plant type.

**Step 4:** The total cost of the minimum sized plant divided by the total cost of the actual sized distribution plant in the field. This ratio is deemed to be the customer-related portion of distribution plant investment, with the balance being the capacity-related portion.

The assumed minimum property unit configurations were determined by the Company's Distribution Engineering area according to its field experience and its evaluation of the smallest practical-sized equipment inventories held in the Company's inventory.

## 3. Steps for Completing a Zero Intercept Study

The steps for completing a zero or minimum intercept are described on pages 92-94 of the NARUC manual. A zero intercept study requires considerable more data and analysis than a minimum system study. A zero intercept study requires the following data:

- A listing of all the configurations of equipment installed for the following for the following distribution property units:
  - Overhead Primary Conductor
  - Overhead Secondary Conductor
  - Overhead Transformers
  - Underground Primary Conductor
  - Underground Secondary Conductor
  - Underground Transformers
  - Primary Voltage Stepdown Transformers
- For each of the above property units, the equipment inventory is obtained for each property unit configuration.
- The maximum capacity rating for each property unit configuration.
  - Ampacity for conductors
  - kVa for transformers

- The installed cost per unit for the most common property unit configurations.

After the above data is acquired, the following analysis steps are taken to complete a zero intercept study:

**Step 1:** The statistical analysis technique called linear regression is applied to the data acquired for each property unit. Specifically, the variable “cost per unit” as the dependent variable (Y axis) is regressed on the variable “maximum capacity” as the independent variable (X axis). The point where the regression line crosses the Y intercept is the theoretical “zero load” cost per unit.

**Step 2:** The zero load cost per unit is multiplied by the total inventory of the distribution property unit.

**Step 3:** The installed cost per unit for the most common property configurations is multiplied by the inventory of each configuration. The resulting product is then summed for each property unit.

**Step 4:** The result from step 2 is divided by the result from step 3. This ratio is classified as the customer component for each property unit.

#### **4. Minimum System and Zero Intercept Data Sources**

In short, data on the types, configurations, sizes and quantities of distribution equipment were obtained by querying the Company’s Geographic Information System (GIS). Data on the installed unit costs for each equipment configuration were obtained by analyzing the costs distribution work orders that were completed from 2007-2020. The goal in this data gathering step was to obtain installed costs for equipment configuration that comprise 90% of the population for a given property unit (i.e. underground primary conductor).

#### **5. Analysis Results**

The data and results of the minimum system and zero intercept studies are shown in Attachments A to P of Schedule 6.

Attachments A to F show the inventory of the different equipment configurations for each property unit.

Attachment G shows the inventory of primary voltage distribution transformers. As shown in Table 1 above, there is no customer component to this property unit. Attachment G also

shows the installed cost per unit and total replacement cost for primary voltage transformers so that transformer plant investment can be separated into primary and secondary voltages.

Attachments H through M show the graphical results of the zero intercept linear regression analysis for each property unit.

Attachment N shows the detailed minimum system and zero intercept calculations.

- Column 1: Lists the property unit.
- Column 2: For primary conductor, indicates if it's 1 phase or 3 phase.
- Column 3: Lists the specific configuration of the equipment.
- Column 4: Lists the inventory of the equipment configuration.
- Column 5: Shows the percent of total equipment total inventory that the specific configuration makes up.
- Column 6: Shows the cumulative percent of inventory that the configuration included in the study make up. As shown in Column 6, the Distribution Engineering area provided cost data for equipment configurations that make up 90% of the total inventory for a given property unit.
- Column 7: Shows the load carrying capacity of the given equipment configuration.
- Column 8: Shows the per unit installed cost as determined by the Distribution Engineering area.
- Column 9: Calculates the total cost of each equipment configuration by multiplying its equipment inventory in Column 4 by the per unit installed cost in Column 8. This result is summed across all equipment configurations to provide total installed costs for a given property unit.
- Column 10: Shows the cost per unit that was determined using the zero intercept method. This was determined by conducting a linear regression analysis using load carrying capacity (in Column 7) as the independent variable, with cost per unit (in Column 8) as the dependent variable.
- Column 11: Calculates total cost of each equipment configuration assuming the zero intercept cost is the cost per unit for all equipment configurations. The equipment inventory in Column 4 is multiplied by the zero intercept cost in Column 10. This result is summed across all equipment configurations to provide total cost for a given property unit, assuming the zero intercept cost is the cost for all equipment configurations. This total for a given property unit divided by the same total in Column 9 is the percent of costs that should be classified as customer-related using the zero intercept approach.
- Column 12: Shows the per unit installed cost of the minimum sized equipment configuration.
- Column 13: Calculates total cost of each equipment configuration assuming the cost of minimum system equipment configuration is the cost per unit for all

equipment configurations. The equipment inventory in Column 4 is multiplied by the cost of the minimum system unit in Column 12. This result is summed across all equipment configurations to provide total cost for a given property unit assuming the cost of the minimum system unit is the cost for all equipment configurations. This total for a given property unit divided by the same total in Column 9 is the percent of costs that should be classified as customer-related using the minimum system approach.

Table 2 below shows the percent of costs that would be classified as customer related using the minimum system method compared to the zero intercept method. As shown in Table 2, for 5 of the 6 property units the zero intercept method provided a lower customer component, while 1 of the 6 have a lower customer component using the minimum system method.

**Table 2**  
**Percent of Distribution Plant Investment Classified as Customer-Related**  
**Zero Intercept Method vs. the Minimum System Method**

Equipment Type	% of Costs Classified as “Customer” Related	
	Minimum/Zero Intercept Method	Minimum Distribution System Method
Overhead Lines Primary	24.0%	63.2%
Overhead Lines Secondary	79.9%	96.0%
Overhead Transformers	69.1%	78.0%
Underground Lines Primary	34.7%	63.8%
Underground Lines Secondary	58.6%	100%
Underground Transformers	70.2%	66.7%

#### **6. Application of Minimum System and Zero Intercept Results to Distribution Plant Investment**

For a given property unit the Company used a “hybrid” of the two methods by applying the result that provided the lowest customer component as shown in Table 3 below.

**Table 3**  
**Customer vs. Capacity Classification Applied to Distribution Plant Investment**

<b>Property Unit</b>	<b>% Customer Related</b>	<b>% Capacity Related</b>
Overhead Lines Primary (used Zero Intercept Result)	24.0%	76.0%
Overhead Lines Secondary (used Zero Intercept Result)	79.9%	20.1%
Underground Lines Primary (used Zero Intercept Result)	34.7%	65.3%
Underground Lines Secondary (used Zero Intercept Result)	58.6%	41.4%
Weighted Average for Overhead & Underground Transformers (used Zero Intercept for OH Transformers; used Minimum System for UG Transformers)	68.1%	31.9%

Attachment O of Schedule 8 shows how the above results from the minimum system and zero intercept analyses are used to provide the needed cost separations.

The first step is to multiply the total inventory of each property unit (shown in Column 1) by the overall cost per unit (shown in Column 2) to provide the total replacement cost (shown in Column 3). The total replacement costs for each property unit are shown in percentages in Column 4.

These percentages are then applied to the Total Test Year Plant in Service as provided from the Jurisdictional Cost of Service Study (JCOSS) to separate costs into sub-function. The Total Test Year Plant in Service from the JCOSS is shown in Attachment O on line 11, column 5 for Overhead Distribution Plant; on line 22, column 5 for Underground Distribution Plant; and on line 27, column 5 for transformers. (Note that the cost of Overhead Distribution Plant that is directly assigned to the Lighting class was quantified as shown on Table 4 of Christopher Barthol's Direct Testimony). For Overhead Distribution Lines, the result as shown in Column 5 is a separation of Overhead Plant in Service costs into the following sub-functions:

- Overhead Primary Single Phase Lines (line 3)
- Overhead Primary Multi Phase Lines (line 6)
- Overhead Secondary Lines (line 9)
- Lighting (line 10)

For Underground Lines, there was no direct assignment to the Lighting class. The result as shown in Column 5 is a separation of Underground Plant in Service costs into the following sub-functions:

- Underground Primary Single Phase Lines (line 14)
- Underground Primary Multi Phase Lines (line 17)
- Underground Secondary Lines (line 20)

For Transformers, the result shown in Column 5 is a separation of Plant in Service costs into the following sub-functions:

- Primary Voltage Transformers (line 23)
- Secondary Voltage Transformers (line 26)

The final step as shown in Column 7 of Attachment O, was to apply the associated Customer & Capacity percentages as shown in Column 6 of Attachment O to the corresponding Plant in Service costs as shown in Column 5. The final result in Column 7 is a separation of distribution plant costs into sub-function and cost classification. These are the inputs to the CCOSS model for the 2024 test year as shown in Schedule 4, page 4, column 1, lines 19 – 42.

## **7. Distribution Service Drops**

Although FERC (as shown in Table 1) and many utilities classify distribution services as only being customer-related, the Company has split these costs into capacity and customer-related components. The Company does not have detailed property records on the configuration or footage of distribution service drops. As such, it was not possible to conduct a detailed minimum system or zero intercept studies as described above. As a substitute a simplified minimum system analysis was conducted as shown in Attachment P.

Column 2 of Attachment P lists the minimum conductor configuration used by the Company in Overhead and Underground applications.

In column 3 we assumed a minimum footage per service of 50 feet.

In order to get an estimated cost per foot for each conductor configuration, staff in the Distribution Design ran a number of service installation work orders through the Company's distribution design software. The resulting unit costs are shown in column 4.

The Total Installed Costs for minimum service drop configuration as shown in column 6 is obtained by multiplying the Minimum Service Footage (column 3) by the Unit Cost per Foot (column 4) by the number of customers with overhead or underground services (column 5). The total minimum installed cost (column 6 total) is divided by total plant investment for distribution services (column



7). This is percent of distribution service costs that was classified as customer-related as shown in column 8.

<u>Phase</u>	<u>Configuration Details Underground</u>		<u>% of 1 Phase</u>	<u>Cumulative % of 1</u>	<u>% of All UG</u>	<u>Cumulative % of All UG</u>
	<u>Primary</u>	<u>Footage</u>	<u>Footage</u>	<u>Phase Footage</u>	<u>Primary</u>	<u>Primary</u>
1 Phase	1/0 AL 1ph	16,024,349	50.84%	50.84%	28.67%	28.67%
	2 AL 1ph	14,788,376	46.92%	97.76%	26.46%	55.14%
	1 AL 1ph	284,143	0.90%	98.66%	0.51%	55.65%
	1/0 Unknown 1ph	214,004	0.68%	99.34%	0.38%	56.03%
	Unknown AL 1ph	77,809	0.25%	99.59%	0.14%	56.17%
	Unknown Unknown 1ph	46,349	0.15%	99.73%	0.08%	56.25%
	2 Unknown 1ph	31,174	0.10%	99.83%	0.06%	56.31%
	1/0 CU 1ph	16,095	0.05%	99.88%	0.03%	56.34%
	2/0 AL 1ph	13,610	0.04%	99.93%	0.02%	56.36%
	2 CU 1ph	4,767	0.02%	99.94%	0.01%	56.37%
	Unknown CU 1ph	4,504	0.01%	99.96%	0.01%	56.38%
	4/0 AL 1ph	3,999	0.01%	99.97%	0.01%	56.38%
	1/0 N/A 1ph	1,921	0.01%	99.97%	0.00%	56.39%
	<b>Footage of 13 Remaining 1 Phase Underground Primary Conductor Configurations</b>	8,015	0.03%	100.00%	0.01%	56.40%
	<b>Total 1 Phase</b>	<b>31,519,114</b>	<b>100.00%</b>		<b>56.40%</b>	
3 Phase	<u>Config Details Underground Primary</u>	<u>Footage</u>	<u>% of 3 Phase</u>	<u>Cumulative % of 3</u>	<u>% of All UG</u>	<u>Cumulative % of All UG</u>
	1/0 AL 3ph	14,140,772	58.04%	58.04%	25.30%	25.30%
	750 AL 3ph	4,826,798	19.81%	77.85%	8.64%	33.94%
	2 AL 3ph	933,040	3.83%	81.68%	1.67%	35.61%
	600 CU 3ph	860,560	3.53%	85.21%	1.54%	37.15%
	500 CU 3ph	753,701	3.09%	88.30%	1.35%	38.50%
	1000 AL 3ph	534,454	2.19%	90.50%	0.96%	39.46%
	500 AL 3ph	459,969	1.89%	92.38%	0.82%	40.28%
	750 CU 3ph	436,689	1.79%	94.18%	0.78%	41.06%
	<b>Footage of 32 Remaining 3 Phase Underground Primary Conductor Configurations</b>	1,418,738	5.82%	100.00%	2.54%	43.60%
	<b>Total 3 Phase</b>	<b>24,364,721</b>	<b>100.00%</b>		<b>43.60%</b>	
	<b>Total Underground Primary</b>	<b>55,883,835</b>			<b>100.00%</b>	

<u>Configuration Details Underground Secondary</u>	<u>Total Footage</u>	<u>% of UG Secondary</u>	<u>Cumulative % UG Secondary</u>
6 AL Duplex	9,878,341	36.70%	36.70%
4/0 AL Triplex	8,355,002	31.04%	67.73%
2/0 AL Triplex	2,679,564	9.95%	77.69%
1/0 AL Triplex	1,460,657	5.43%	83.11%
6 CU Open Wire	1,206,909	4.48%	87.60%
350 AL Triplex	660,658	2.45%	90.05%
6 CU Triplex	285,950	1.06%	91.11%
2 AL Triplex	262,510	0.98%	92.09%
8 CU Open Wire	262,460	0.97%	93.06%
4 CU Open Wire	209,884	0.78%	93.84%
6 AL Triplex	208,881	0.78%	94.62%
8 CU Triplex	176,892	0.66%	95.28%
4 CU Triplex	108,269	0.40%	95.68%
4 AL Triplex	91,919	0.34%	96.02%
4 CU Duplex	77,412	0.29%	96.31%
Unknown Unknown Unknown	60,147	0.22%	96.53%
2 Unknown Triplex	59,507	0.22%	96.75%
4 CU N/A	55,480	0.21%	96.96%
2 Unknown Open Wire	49,863	0.19%	97.14%
Unknown Unknown Unknown	41,769	0.16%	97.30%
2 Unknown Duplex	33,248	0.12%	97.42%
4/0 AL Quadraplex	32,738	0.12%	97.54%
0 0 Unknown	32,072	0.12%	97.66%
8 AL Triplex	28,527	0.11%	97.77%
2 AL Duplex	26,950	0.10%	97.87%
6 CU Unknown	25,540	0.09%	97.96%
6 CU N/A	25,400	0.09%	98.06%
Unknown Unknown Triplex	24,459	0.09%	98.15%
6 CU Quadraplex	23,525	0.09%	98.24%
6 AL Open Wire	21,387	0.08%	98.32%
0 0 Duplex	20,947	0.08%	98.39%
500 CU Quadraplex	20,641	0.08%	98.47%
0 0 Triplex	18,279	0.07%	98.54%
Unknown Unknown Duplex	15,757	0.06%	98.60%
8 CU Duplex	15,372	0.06%	98.65%
6 CU Duplex	14,750	0.05%	98.71%
6 Unknown Duplex	12,764	0.05%	98.76%
4/0 AL Duplex	11,864	0.04%	98.80%
8 CU Duplex	11,130	0.04%	98.84%
350 AL Duplex	9,872	0.04%	98.88%
8 AL Duplex	9,563	0.04%	98.91%
 <b>Footage of 156 Remaining Underground Secondary Conductor Configurations</b>	 292,625	 1.09%	 100.00%
 <b>Total Underground Secondary</b>	 <b>26,919,485</b>	 <b>100.00%</b>	

Northern States Power Company

Inventory of Underground Transformers by Transformer Configuration

Docket No. EL25-\_\_

Exhibit\_\_ (CJB-1), Schedule 6

Attachment C - Page 1 of 2

<u>Configuration Details 1 Phase Underground Transformers</u>	<u>Number of Transformers</u>	<u>1 Phase %</u>	<u>Cumulative Percent of 1 Phase Transformers</u>	<u>% of All Underground Transformers</u>	<u>Cumulative Percent of All Transformers</u>
1 Phase Wye 50 kVA	31,125	49.71%	49.71%	35.41%	35.41%
1 Phase Wye 25 kVA	17,418	27.82%	77.52%	19.81%	55.22%
1 Phase Wye 37.5 kVA	8,619	13.76%	91.29%	9.81%	65.03%
1 Phase Wye 15 kVA	2,258	3.61%	94.89%	2.57%	67.60%
1 Phase Wye 100 kVA	1,431	2.29%	97.18%	1.63%	69.22%
1 Phase Wye 75 kVA	1,226	1.96%	99.14%	1.39%	70.62%
1 Phase Wye 10 kVA	279	0.45%	99.58%	0.32%	70.94%
1 Phase Wye 167 kVA	214	0.34%	99.92%	0.24%	71.18%
1 Phase Wye 250 kVA	15	0.02%	99.95%	0.02%	71.20%
1 Phase Wye Unknown kVA	7	0.01%	99.96%	0.01%	71.20%
1 Phase Wye 35 kVA	6	0.01%	99.97%	0.01%	71.21%

**Number of Transformers for 12 Remaining Single Phase Transformer Configurations**

19	0.03%	100.00%	0.02%	71.23%
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**Total 1 Phase Transformers**

<b>62,617</b>	<b>100.00%</b>		<b>71.23%</b>
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<u>Configuration Details 2 Phase Underground Transformers</u>	<u>Number of Transformers</u>	<u>2 Phase %</u>	<u>Cumulative Percent of 2 Phase Transformers</u>	<u>% of All UG Transformers</u>	<u>Cumulative Percent of All Transformers</u>
2 Phase Wye/Delta 75 kVA	274	31.49%	31.49%	0.31%	0.31%
2 Phase Wye/Delta 125 kVA	173	19.89%	51.38%	0.20%	0.51%
2 Phase Wye/Delta 204.5 kVA	106	12.18%	63.56%	0.12%	0.63%
2 Phase Wye/Delta 300 kVA	61	7.01%	70.57%	0.07%	0.70%
2 Phase Wye/Delta 50 kVA	57	6.55%	77.13%	0.06%	0.76%
2 Phase Wye/Delta 100 kVA	37	4.25%	81.38%	0.04%	0.81%
2 Phase Wye/Delta 62.5 kVA	28	3.22%	84.60%	0.03%	0.84%
2 Phase Wye/Delta 150 kVA	19	2.18%	86.78%	0.02%	0.86%
2 Phase Wye/Delta 30 kVA	15	1.72%	88.51%	0.02%	0.88%
2 Phase Wye/Delta 87.5 kVA	12	1.38%	89.89%	0.01%	0.89%

**Number of Transformers for 26 Remaining 2 Phase Transformer Configurations**

88	10.11%	100.00%	0.10%	0.99%
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**Total 2 Phase Transformers**

<b>870</b>	<b>100.00%</b>		<b>0.99%</b>
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Northern States Power Company

Inventory of Underground Transformers by Transformer Configuration

Docket No. EL25-\_\_

Exhibit\_\_(CJB-1), Schedule 6

Attachment C - Page 2 of 2

<u>Configuration Details 3 Phase Underground Transformers</u>	<u>Number of Transformers</u>	<u>3 Phase %</u>	<u>Cumulative Percent of 3 Phase Transformers</u>	<u>% of All UG Transformers</u>	<u>Cumulative Percent of All Transformers</u>
3 Phase Wye/Wye 150 kVA	3,986	16.32%	16.32%	4.53%	4.53%
3 Phase Wye/Wye 300 kVA	3,834	15.70%	32.03%	4.36%	8.90%
3 Phase Wye/Wye 75 kVA	3,656	14.97%	47.00%	4.16%	13.06%
3 Phase Wye/Wye 500 kVA	3,255	13.33%	60.33%	3.70%	16.76%
3 Phase Wye/Wye 750 kVA	1,954	8.00%	68.33%	2.22%	18.98%
3 Phase Wye/Wye 112 kVA	1,932	7.91%	76.25%	2.20%	21.18%
3 Phase Wye/Wye 225 kVA	1,752	7.18%	83.42%	1.99%	23.17%
3 Phase Wye/Wye 1000 kVA	1,452	5.95%	89.37%	1.65%	24.82%
3 Phase Wye/Wye 1500 kVA	1,151	4.71%	94.08%	1.31%	26.13%
3 Phase Wye/Wye 45 kVA	506	2.07%	96.15%	0.58%	26.71%
3 Phase Wye/Wye 2000 kVA	491	2.01%	98.17%	0.56%	27.27%
3 Phase Wye/Wye 2500 kVA	135	0.55%	98.72%	0.15%	27.42%
<b>Number of Transformers for 72 Remaining 3 Phase Transformer Configurations</b>	313	1.28%	100.00%	0.36%	27.78%
<b>Total 3 Phase Transformers</b>	<b>24,417</b>	<b>100.00%</b>		<b>27.78%</b>	
<b>Total Underground Transformers</b>	<b>87,904</b>			<b>100.00%</b>	

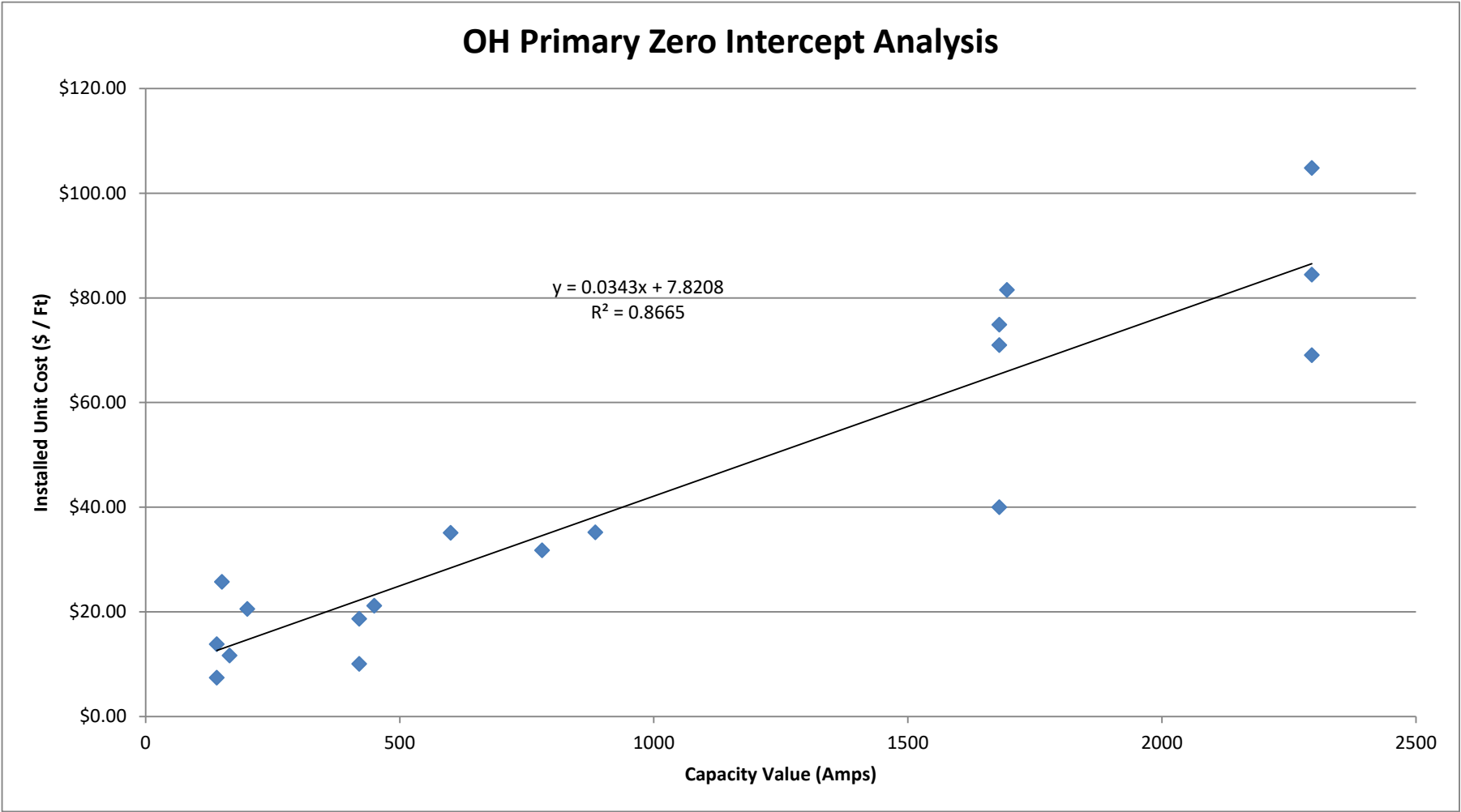
Phase	Configuration Details Overhead Primary	Footage	% of 1 Phase Footage	Cumulative % of		% of All OH Primary	Cumulative % of All OH Primary
				1 Phase Footage	Footage		
1 Phase	4 ACSR 1ph	10,698,423	26.59%	26.59%	26.59%	15.28%	15.28%
	2 ACSR 1ph	10,139,492	25.20%	51.79%	51.79%	14.49%	29.77%
	6A CUWD 1ph	7,459,455	18.54%	70.33%	70.33%	10.66%	40.43%
	6 CU 1ph	6,943,615	17.26%	87.59%	87.59%	9.92%	50.35%
	3/10 CU 1ph	1,564,708	3.89%	91.48%	91.48%	2.24%	52.58%
	4 CU 1ph	764,837	1.90%	93.38%	93.38%	1.09%	53.68%
	Unknown Unknown 1ph	753,427	1.87%	95.26%	95.26%	1.08%	54.75%
	2/0 ACSR 1ph	239,332	0.59%	95.85%	95.85%	0.34%	55.10%
	3/8 CU 1ph	201,915	0.50%	96.35%	96.35%	0.29%	55.38%
	6 CUWD 1ph	173,814	0.43%	96.78%	96.78%	0.25%	55.63%
	8A CUWD 1ph	164,182	0.41%	97.19%	97.19%	0.23%	55.87%
	2 CU 1ph	145,776	0.36%	97.55%	97.55%	0.21%	56.08%
	Unknown CU 1ph	135,674	0.34%	97.89%	97.89%	0.19%	56.27%
	1/0 ACSR 1ph	135,210	0.34%	98.23%	98.23%	0.19%	56.46%
	130 Steel 1ph	75,306	0.19%	98.42%	98.42%	0.11%	56.57%
	4A CUWD 1ph	69,548	0.17%	98.59%	98.59%	0.10%	56.67%
	1/0 CU 1ph	67,877	0.17%	98.76%	98.76%	0.10%	56.77%
	336 ACSR 1ph	58,553	0.15%	98.90%	98.90%	0.08%	56.85%
	336 AL 1ph	49,374	0.12%	99.02%	99.02%	0.07%	56.92%
	3/6 CU 1ph	36,084	0.09%	99.11%	99.11%	0.05%	56.97%
	<b>Footage of 62 Remaining Single Phase Overhead Primary Conductor Configurations</b>	356,241	0.89%	100.00%		0.51%	57.48%
	<b>Total 1 Phase</b>	<b>40,232,843</b>	<b>100.00%</b>			<b>57.48%</b>	
Phase	Config Details OH Primary	Footage	% of 3 Phase Footage	Cumulative % of		% of All OH Primary	Cumulative % of All OH Primary
				3 Phase Footage	Footage		
3 Phase	336 AL 3ph	6,449,212	21.67%	21.67%	21.67%	9.21%	9.21%
	2 ACSR 3ph	5,828,121	19.58%	41.25%	41.25%	8.33%	17.54%
	336 ACSR 3ph	5,187,129	17.43%	58.68%	58.68%	7.41%	24.95%
	2/0 ACSR 3ph	2,335,697	7.85%	66.53%	66.53%	3.34%	28.29%
	4 ACSR 3ph	1,756,872	5.90%	72.43%	72.43%	2.51%	30.80%
	6 CU 3ph	1,294,407	4.35%	76.78%	76.78%	1.85%	32.65%
	4/0 CU 3ph	820,787	2.76%	79.54%	79.54%	1.17%	33.82%
	6A CUWD 3ph	733,392	2.46%	82.01%	82.01%	1.05%	34.87%
	1/0 ACSR 3ph	719,893	2.42%	84.43%	84.43%	1.03%	35.90%
	<b>Footage of 85 Remaining 3 Phase Overhead Primary Conductor Configurations</b>	4,635,222	15.57%	114.18%		6.62%	42.52%
	<b>Total 3 Phase</b>	<b>29,760,732</b>	<b>100.00%</b>			<b>42.52%</b>	
	<b>Total Overhead Primary</b>	<b>69,993,575</b>				<b>100.00%</b>	

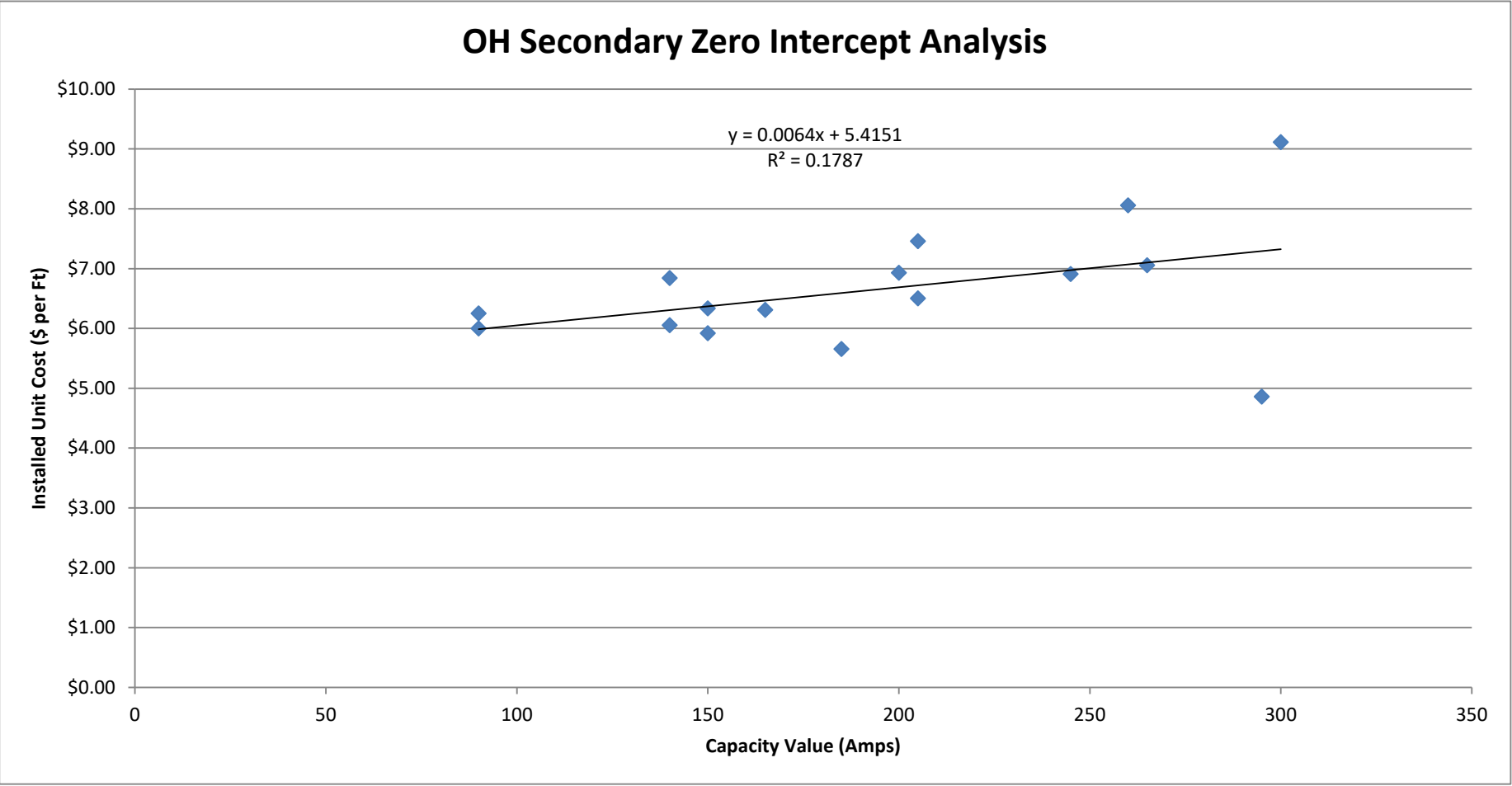
<u>Configuration Details Overhead</u>		<u>% of Total Overhead</u>	<u>Cumulative % Overhead</u>
<u>Secondary</u>	<u>Total Footage</u>	<u>Secondary</u>	<u>Secondary</u>
2 ACSR Open Wire	20,338,802	14.90%	14.90%
1/0 ACSR Open Wire	18,334,359	13.43%	28.34%
4 CU Open Wire	15,181,580	11.12%	39.46%
2 CU Open Wire	14,916,284	10.93%	50.39%
6 CU Open Wire	9,845,756	7.21%	57.61%
4 ACSR Open Wire	9,718,445	7.12%	64.73%
1/0 AL Triplex	7,573,248	5.55%	70.28%
1/0 AL Triplex, Lashed	6,721,759	4.93%	75.21%
6A CUWD Open Wire	6,296,098	4.61%	79.82%
6 ACSR Duplex	4,852,695	3.56%	83.37%
2 AL Triplex	2,723,553	2.00%	85.37%
1/0 CU Open Wire	2,505,605	1.84%	87.21%
3/10 CU Open Wire	1,505,128	1.10%	88.31%
1/0 AL Open Wire	1,294,876	0.95%	89.26%
6 AL Duplex	1,292,144	0.95%	90.21%
2/0 ACSR Open Wire	915,530	0.67%	90.88%
2 ACSR N/A	790,708	0.58%	91.46%
Unknown CU Open Wire	785,058	0.58%	92.03%
2 AL Open Wire	725,975	0.53%	92.56%
3/8 CU Open Wire	688,413	0.50%	93.07%
6 AL Triplex	685,906	0.50%	93.57%
1/0 ACSR Quadruplex	495,596	0.36%	93.93%
2/0 ACSR Neutral	491,289	0.36%	94.29%
2 ACSR Neutral	486,200	0.36%	94.65%
2 ACSR Triplex	409,132	0.30%	94.95%
2 ACSR Triplex, Lashed	335,042	0.25%	95.19%
1/0 ACSR Triplex, Lashed	301,632	0.22%	95.42%
3/8 CU Open Wire	295,701	0.22%	95.63%
4 ACSR Triplex	213,935	0.16%	95.79%
4/0 ACSR Quadruplex	193,454	0.14%	95.93%
Unknown Unknown Unknown	185,375	0.14%	96.07%
4/0 AL Triplex	185,375	0.14%	96.20%
6 CUWD Open Wire	160,520	0.12%	96.32%
4 Unknown Open Wire	160,430	0.12%	96.44%
8A CUWD Open Wire	155,387	0.11%	96.55%
4 AL Open Wire	147,393	0.11%	96.66%
3/6 CU Open Wire	145,023	0.11%	96.77%
0 0 Open Wire	133,292	0.10%	96.86%
1/0 AL Quadruplex	126,111	0.09%	96.96%
4 ACSR Duplex	122,825	0.09%	97.05%
 <b>Footage of 494 Remaining Overhead Secondary Conductor Configurations</b>	 4,031,541	 2.95%	 100.00%
 <b>Total OH Secondary</b>	 <b>136,467,174</b>	 <b>100.00%</b>	

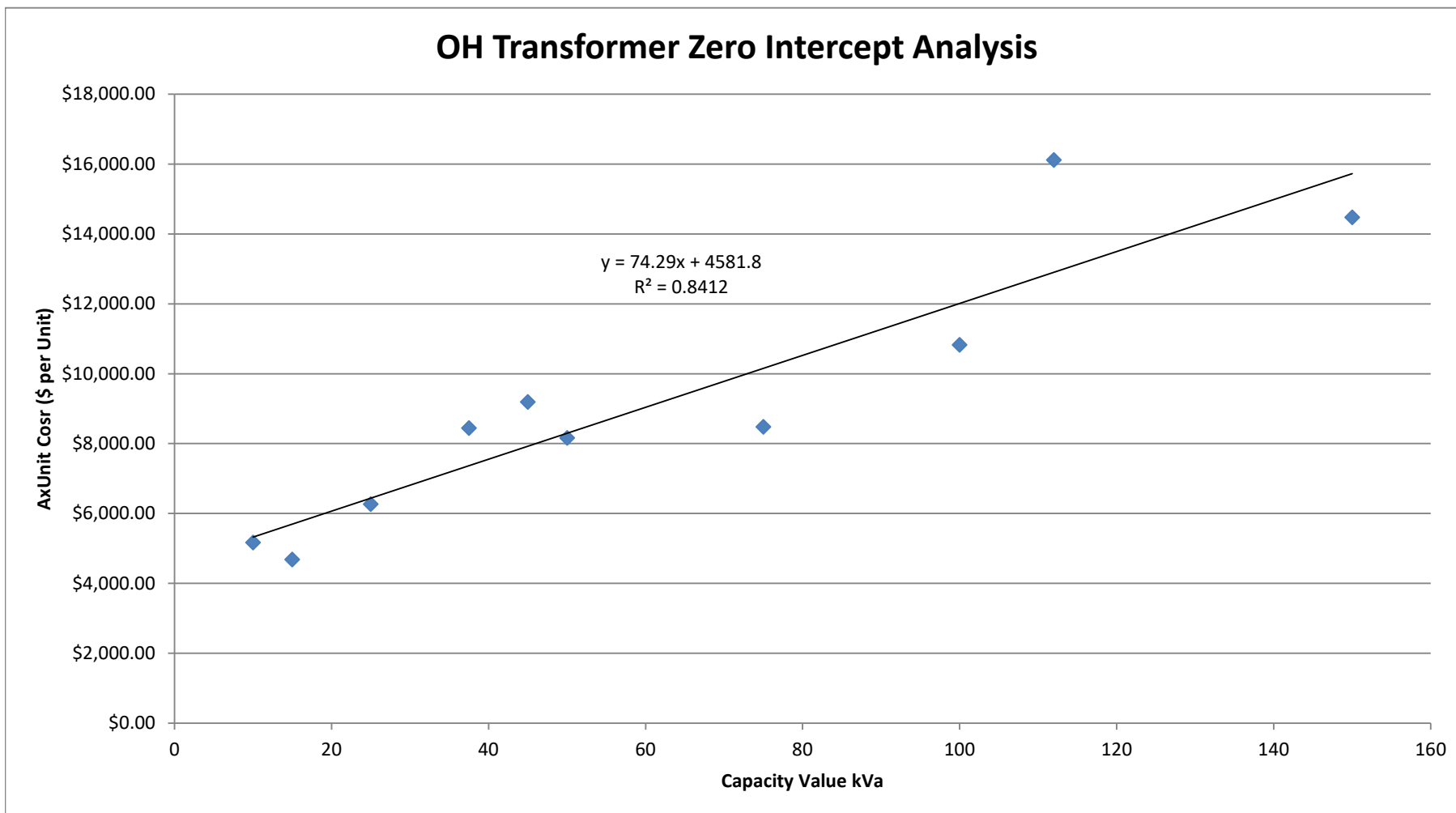
<u>Config Details 1 Phase Overhead Transformers</u>	<u>Number of Transformers</u>	<u>1 Phase %</u>	<u>1 Phase Cumulative %</u>	<u>% of All Overhead Transformers</u>	<u>Cumulative Percent of All OH Transformers</u>
1 Phase Wye 25 kVA	33,552	33.33%	33.33%	29.66%	29.66%
1 Phase Wye 10 kVA	17,527	17.41%	50.73%	15.50%	45.16%
1 Phase Wye 15 kVA	17,194	17.08%	67.81%	15.20%	60.36%
1 Phase Wye 37.5 kVA	15,358	15.25%	83.07%	13.58%	73.94%
1 Phase Wye 50 kVA	14,750	14.65%	97.72%	13.04%	86.98%
1 Phase Wye 75 kVA	773	0.77%	98.49%	0.68%	87.66%
1 Phase Wye 100 kVA	657	0.65%	99.14%	0.58%	88.24%
1 Phase Wye 5 kVA	368	0.37%	99.50%	0.33%	88.57%
1 Phase Wye 0.5 kVA	116	0.12%	99.62%	0.10%	88.67%
1 Phase Wye 3 kVA	101	0.10%	99.72%	0.09%	88.76%
1 Phase Wye 167 kVA	58	0.06%	99.78%	0.05%	88.81%
1 Phase Delta 25 kVA	42	0.04%	99.82%	0.04%	88.85%
<b>Number of Transformers for 22 Remaining 1 Phase Transformer Configurations</b>	183	0.18%	100.00%	0.16%	89.01%
<b>Total 1 Phase Transformers</b>	<b>100,679</b>	<b>100.00%</b>		<b>89.01%</b>	
<u>Config Details 2 Phase Overhead Transformers</u>	<u>Number of Transformers</u>	<u>2 Phase %</u>	<u>2 Phase Cumulative %</u>	<u>% of All Overhead Transformers</u>	<u>Cumulative Percent of All OH Transformers</u>
2 Phase Wye/Delta 75 kVA	24	30.77%	30.77%	0.02%	0.02%
2 Phase Wye/Delta 40 kVA	12	15.38%	46.15%	0.01%	0.03%
2 Phase Wye/Delta 50 kVA	7	8.97%	55.13%	0.01%	0.04%
2 Phase Wye/Delta 65 kVA	6	7.69%	62.82%	0.01%	0.04%
2 Phase Wye/Delta 100 kVA	5	6.41%	69.23%	0.00%	0.05%
2 Phase Wye/Delta 150 kVA	4	5.13%	74.36%	0.00%	0.05%
2 Phase Wye/Delta 25 kVA	4	5.13%	79.49%	0.00%	0.05%
2 Phase Wye/Delta 30 kVA	4	5.13%	84.62%	0.00%	0.06%
<b>Number of Transformers for 9 Remaining 2 Phase Transformer Configurations</b>	12	15.38%	100.00%	0.01%	0.07%
<b>Total 2 Phase Transformers</b>	<b>78</b>	<b>100.00%</b>		<b>0.07%</b>	
<u>Config Details 3 Phase OH Transformers</u>	<u>Number of Transformers</u>	<u>3 Phase %</u>	<u>3 Phase Cumulative %</u>	<u>% of All OH Transformers</u>	<u>Cumulative Percent of All OH Transformers</u>
3 Phase Wye/Wye 75 kVA	1,325	10.73%	10.73%	1.17%	1.17%
3 Phase Wye/Wye 150 kVA	1,068	8.65%	19.37%	0.94%	2.12%
3 Phase Wye/Wye 45 kVA	773	6.26%	25.63%	0.68%	2.80%
3 Phase Open Wye/Open Delta 75 kVA	735	5.95%	31.58%	0.65%	3.45%
3 Phase Wye/Wye 112 kVA	548	4.44%	36.02%	0.48%	3.93%
3 Phase Wye/Wye 300 kVA	515	4.17%	40.18%	0.46%	4.39%
3 Phase Open Wye/Open Delta 40 kVA	467	3.78%	43.97%	0.41%	4.80%
3 Phase Open Wye/Open Delta 35 kVA	364	2.95%	46.91%	0.32%	5.12%
3 Phase Open Wye/Open Delta 100 kVA	333	2.70%	49.61%	0.29%	5.42%
3 Phase Open Wye/Open Delta 62.5 kVA	314	2.54%	52.15%	0.28%	5.70%
3 Phase Open Wye/Open Delta 52.5 kVA	295	2.39%	54.54%	0.26%	5.96%
3 Phase Open Wye/Open Delta 65 kVA	293	2.37%	56.91%	0.26%	6.22%
3 Phase Open Wye/Open Delta 20 kVA	288	2.33%	59.24%	0.25%	6.47%
3 Phase Wye/Wye 225 kVA	282	2.28%	61.52%	0.25%	6.72%
3 Phase Open Wye/Open Delta 125 kVA	240	1.94%	63.47%	0.21%	6.93%
<b>Number of Transformers for 155 Remaining 3 Phase Transformer Configurations</b>	4,513	36.53%	100.00%	3.99%	10.92%
<b>Total 3 Phase Transformers</b>	<b>12,353</b>	<b>100.00%</b>		<b>10.92%</b>	
<b>Total OH Transformers</b>	<b>113,110</b>			<b>100.00%</b>	

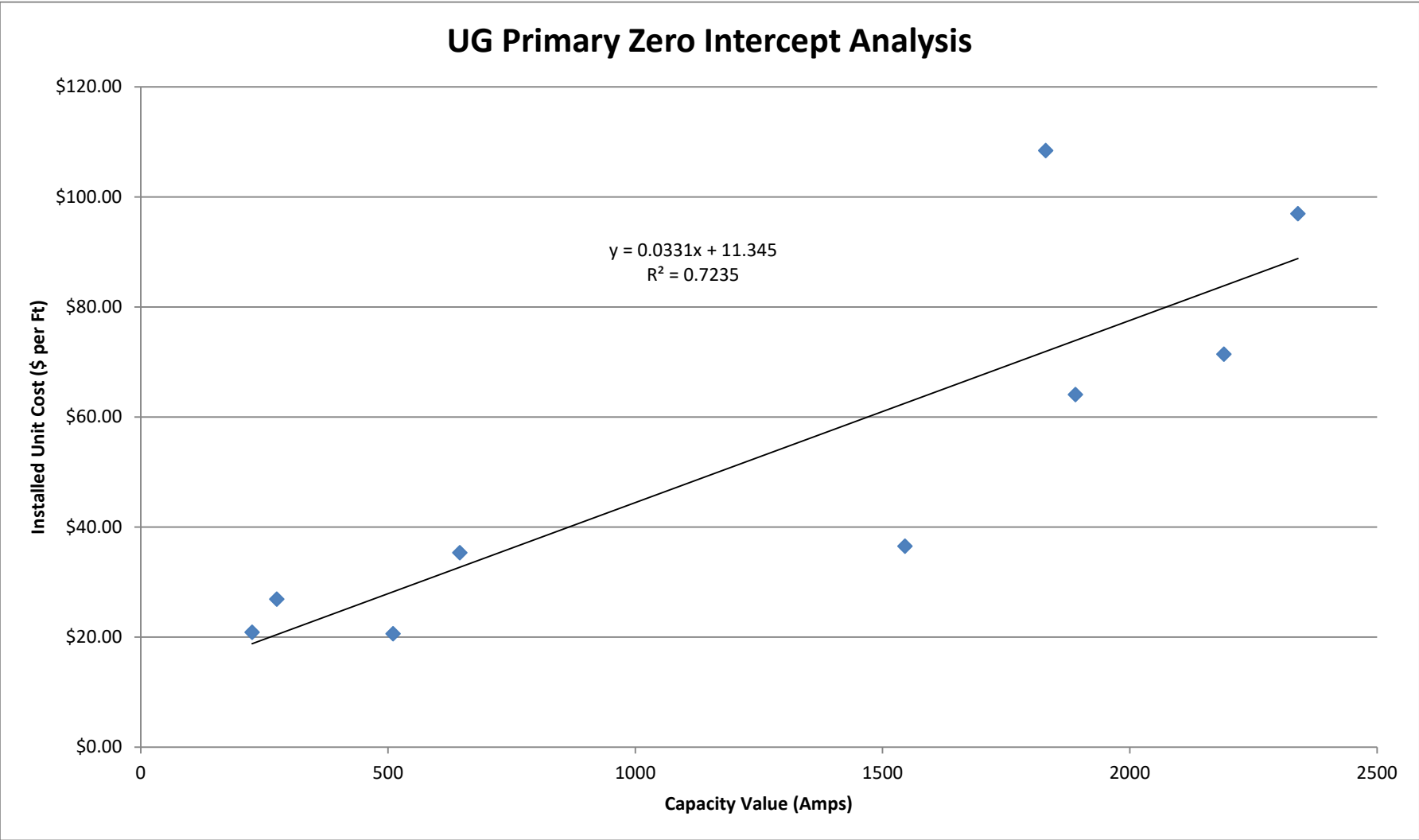


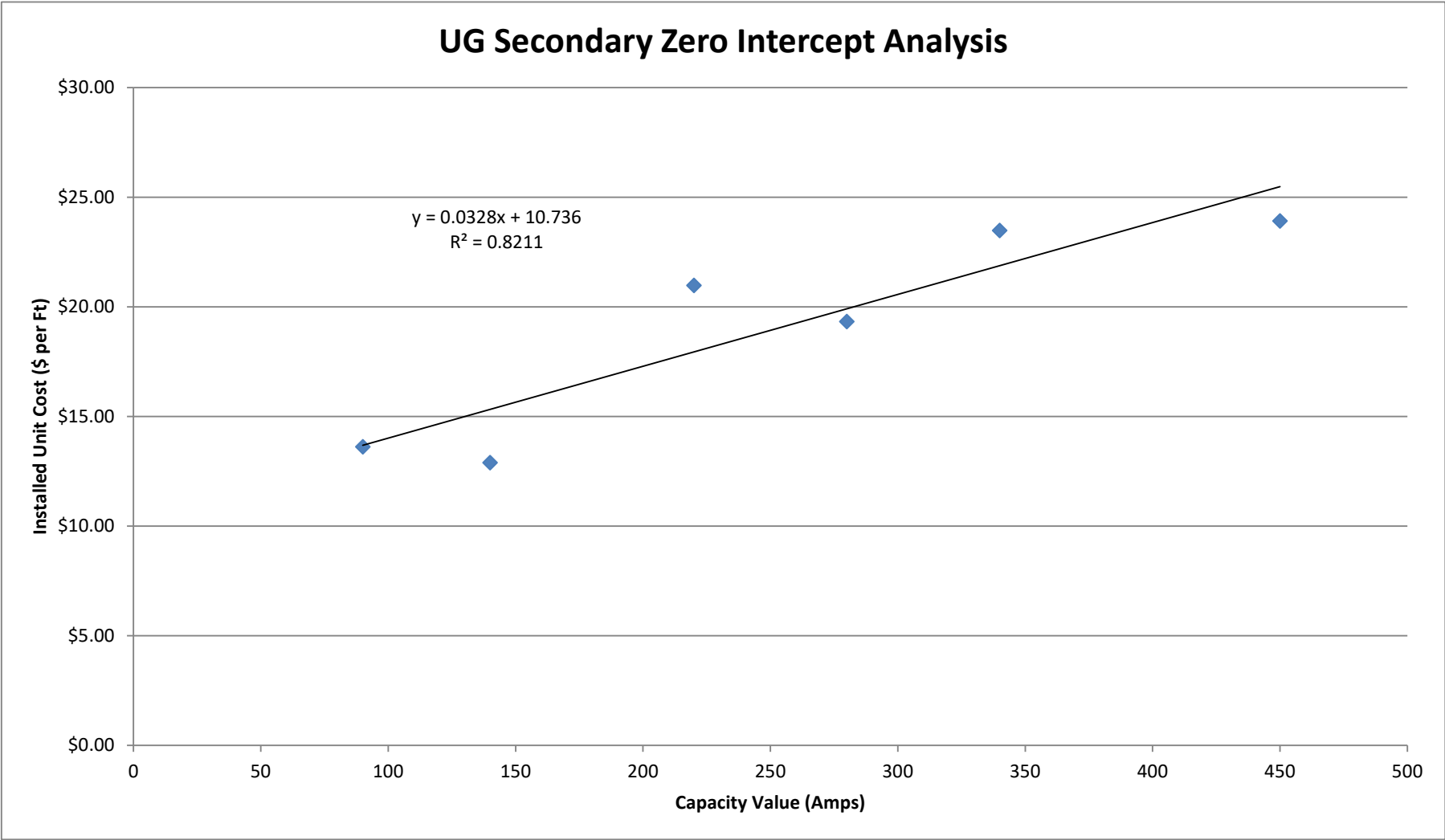
<b>Overhead 1 Phase</b>	<b>Number OH 1 Phase</b>	<b>% of OH 1 Phase</b>	<b>Cumulative % of OH 1 Phase</b>	<b>% of All OH Step-Down Transformers</b>	<b>Load Carrying Capacity (kVA)</b>	<b>Installed Unit Cost</b>	<b>Total Replacement Costs</b>
OH 1 phase 34.5/13.8 kV 500 kVA	240	23.90%	23.90%	18.66%	500	\$102,886	\$24,692,533
OH 1 phase 19.92/7.2 kV 167 kVA	131	13.05%	36.95%	10.19%	167	\$53,067	\$6,951,733
OH 1 phase 34.5/13.8 kV 333 kVA	126	12.55%	49.50%	9.80%	333	\$88,233	\$11,117,400
OH 1 phase 34.5/13.8 kV 250 kVA	121	12.05%	61.55%	9.41%	250	\$72,404	\$8,760,830
OH 1 phase 19.92/7.97 kV 50 kVA	120	11.95%	73.51%	9.33%	50	\$23,489	\$2,818,667
OH 1 phase 19.92/7.2 kV 100 kVA	103	10.26%	83.76%	8.01%	100	\$46,678	\$4,807,811
<b>Number of Transformers and Cost of Transformers for 5 Remaining 1 Phase OH Transformer Configurations</b>	<b>163</b>	<b>16.24%</b>		<b>11.91%</b>		<b>\$291,923.72</b>	<b>\$47,583,567</b>
<b>Total OH 1 Phase</b>	<b>1004</b>	<b>100.00%</b>		<b>78.07%</b>		<b>\$106,307.31</b>	<b>\$106,732,541</b>
<b>Overhead 2 Phase</b>	<b>Number OH 2 Phase</b>	<b>% of OH 2 Phase</b>	<b>Cumulative % of OH 2 Phase</b>	<b>% of All OH Step-Down Transformers</b>	<b>Load Carrying Capacity (kVA)</b>	<b>Installed Unit Cost</b>	<b>Total Replacement Costs</b>
OH 2 phase 13.8/4.16 kV 500 kVA	5	35.71%	35.71%	0.39%	500	\$82,815	\$414,077
OH 2 phase 34.5/13.8 kV 1000 kVA	2	14.29%	50.00%	0.16%	1000	\$140,241	\$280,482
<b>Number of Transformers and Cost of Transformers for 5 Remaining 2 Phase OH Transformer Configurations</b>	<b>7</b>	<b>50.00%</b>		<b>0.54%</b>		<b>\$58,950</b>	<b>\$412,651</b>
<b>Total OH 2 Phase</b>	<b>14</b>	<b>100.00%</b>		<b>1.09%</b>		<b>\$79,086</b>	<b>\$1,107,210</b>
<b>Overhead 3 Phase</b>	<b>Number OH 3 Phase</b>	<b>% of OH 3 Phase</b>	<b>Cumulative % of OH 3 Phase</b>	<b>% of All OH Step-Down Transformers</b>	<b>Load Carrying Capacity (kVA)</b>	<b>Installed Unit Cost</b>	<b>Total Replacement Costs</b>
OH 3 phase 34.5/13.8 kV 1500 kVA	73	27.24%	27.24%	5.68%	1500	\$209,763	\$15,312,663
OH 3 phase 13.8/4.16 kV 1000 kVA	48	17.91%	45.15%	3.73%	1000	\$122,672	\$5,888,250
OH 3 phase 34.5/12.47 750 kVA	35	13.06%	58.21%	2.72%	750	\$99,114	\$3,468,974
OH 3 phase 13.8/4.16 kV 500 kVA	34	12.69%	70.90%	2.64%	500	\$77,198	\$2,624,715
OH 3 phase 34.5/13.8 300 kVA	21	7.84%	78.73%	1.63%	300	\$62,295	\$1,308,195
OH 3 phase 13.8/12.47 kV 5000 kVA	11	4.10%	82.84%	0.86%	5000	\$649,719	\$7,146,906
<b>Number of Transformers and Cost of Transformers for 17 Remaining 3 Phase OH Transformer Configurations</b>	<b>46</b>	<b>17.16%</b>		<b>3.58%</b>		<b>\$96,173</b>	<b>\$4,423,969</b>
<b>Total OH 3 Phase</b>	<b>268</b>	<b>100.00%</b>		<b>20.84%</b>		<b>\$149,902</b>	<b>\$40,173,672</b>
<b>Total OH Step-Down Transformers</b>	<b>1,286</b>					<b>\$115,096</b>	<b>\$148,013,424</b>
<b>Underground 1 Phase</b>	<b>Number UG 1 Phase</b>	<b>% of UG 1 Phase</b>	<b>Cumulative % of UG 1 Phase</b>	<b>% of All UG Step-Down Transformers</b>	<b>Load Carrying Capacity (kVA)</b>	<b>Installed Unit Cost</b>	<b>Total Replacement Costs</b>
UG 1 phase 19.92/7.97 kV 500 kVA	1	33.33%	33.33%	1.20%	500	\$61,508	\$61,508
UG 1 phase 19.92/7.2 333.0 kVA	1	33.33%	66.67%	1.20%	333	\$42,473	\$42,473
UG 1 phase 19.92/7.2 50.0 kVA	1	33.33%	100.00%	1.20%	50	\$5,335	\$5,335
<b>Total UG 1 Phase</b>	<b>3</b>	<b>100.00%</b>		<b>3.61%</b>		<b>\$36,438</b>	<b>\$109,315</b>
<b>Underground 3 Phase</b>	<b>Number UG 3 Phase</b>	<b>% of UG 3 Phase</b>	<b>Cumulative % of UG 3 Phase</b>	<b>% of All UG Step-Down Transformers</b>	<b>Load Carrying Capacity (kVA)</b>	<b>Installed Unit Cost</b>	<b>Total Replacement Costs</b>
UG 3 phase 34.5/13.8 kV 5000 kVA	48	60.00%	60.00%	57.83%	5000	\$683,393	\$32,802,844
UG 3 phase 34.5/13.8 kV 3750 kVA	20	25.00%	85.00%	24.10%	3750	\$1,024,753	\$20,495,056
UG 3 phase 34.5/4.16 kV 11250 kVA	4	5.00%	90.00%	4.82%	11250	\$3,684,733	\$14,738,933
<b>Number of Transformers and Cost of Transformers for 4 Remaining 3 Phase UG Transformer Configurations</b>	<b>8</b>	<b>10.00%</b>		<b>9.64%</b>		<b>\$641,233</b>	<b>\$5,129,861</b>
<b>Total UG 3 Phase</b>	<b>80</b>	<b>100.00%</b>		<b>96.39%</b>		<b>\$914,584</b>	<b>\$73,166,694</b>
<b>Total UG Step-Down Transformers</b>	<b>83</b>						<b>\$73,276,010</b>
<b>All OH &amp; UG Primary Step-Down Transfo</b>	<b>1,369</b>					<b>\$161,643</b>	<b>\$221,289,433</b>

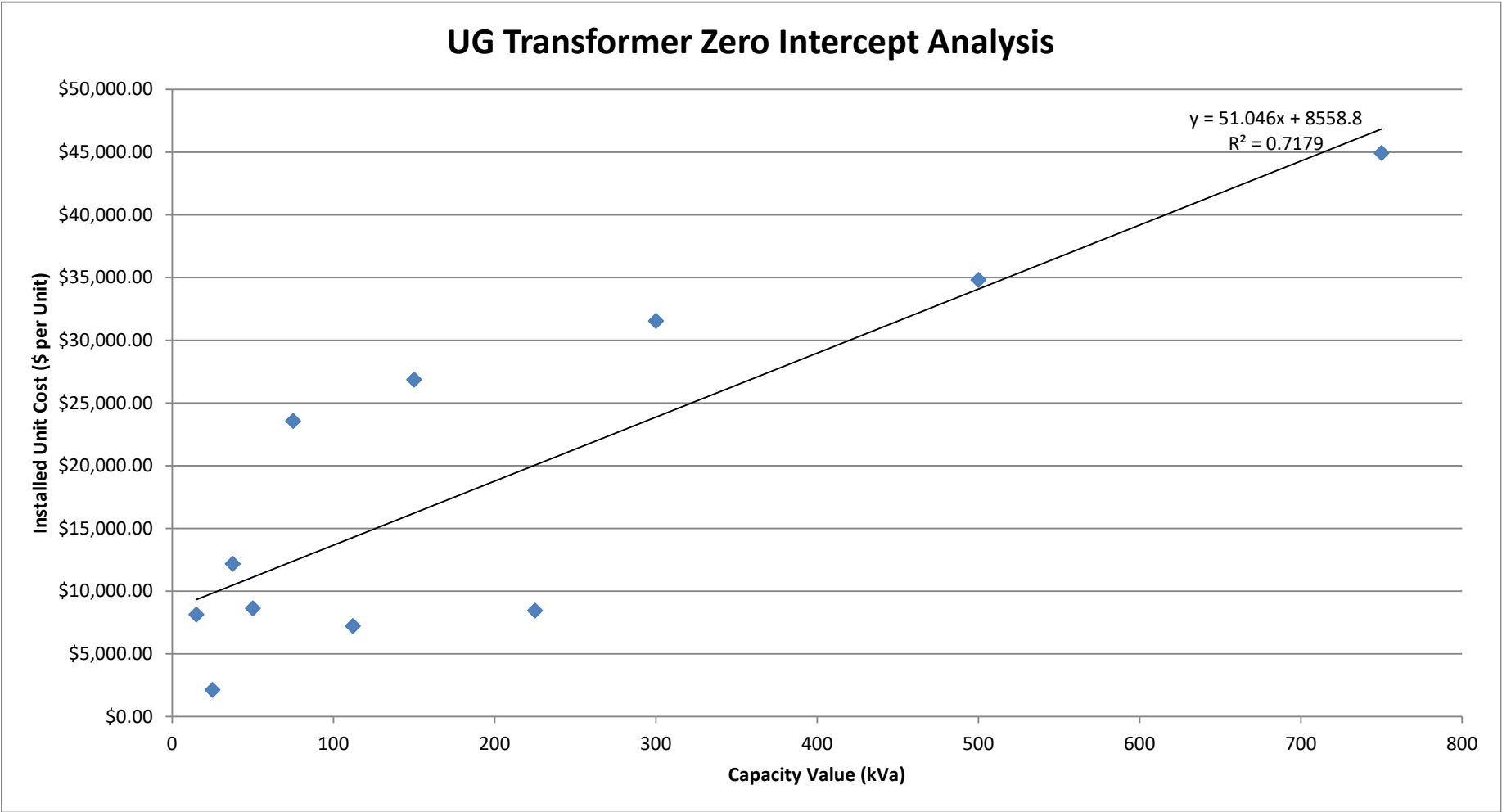












	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9] = [4] x [8]	[10]	[11] = [4] x [10]	[12]	[13] = [4] x [12]
				Conductor Footage/Number Transformers	% of Total Population Footage/ Transformers	Cumulative % of Total Population Footage/ Transformers	Load Carrying Capacity (A, or kVA)	Installed Unit Cost	Total Cost	Y Intercept Minimum Cost per Unit	Total Cost Using Y Intercept Unit Cost	Minimum System Cost per Unit	Total Cost Using Minimum System Cost per Unit
Line	Property Unit	Phase	Config Details										
1	OH Primary	1 ph	4 ACSR 1ph	10,698,423	15.3%	15.3%	150	\$25.73	\$275,322,293	\$7.82	\$83,670,230	\$20.56	\$220,009,945
2	OH Primary	1 ph	2 ACSR 1ph	10,139,492	14.5%	29.8%	200	\$20.56	\$208,515,678	\$7.82	\$79,298,937	\$20.56	\$208,515,678
3	OH Primary	1 ph	6A CUWD 1ph	7,459,455	10.7%	40.4%	140	\$13.85	\$103,293,832	\$7.82	\$58,338,902	\$20.56	\$153,401,499
4	OH Primary	1 ph	6 CU 1ph	6,943,615	9.9%	50.3%	140	\$7.45	\$51,729,929	\$7.82	\$54,304,621	\$20.56	\$142,793,401
5	OH Primary	1 ph	3/10 CU 1ph	<u>1,564,708</u>	2.2%	52.6%	165	<u>\$11.68</u>	<u>\$18,282,341</u>	\$7.82	<u>\$12,237,267</u>	\$20.56	<u>\$32,177,759</u>
6	Total 1 Phase Primary in Sample			36,805,692				\$17.85	\$657,144,073		\$287,849,958		\$756,898,281
7	OH Primary	3 ph	336 AL 3ph	6,449,212	9.2%	61.8%	1680	\$71.01	\$457,964,375	\$7.82	\$50,437,999	\$20.56	\$132,626,161
8	OH Primary	3 ph	2 ACSR 3ph	5,828,121	8.3%	70.1%	600	\$35.10	\$204,561,003	\$7.82	\$45,580,572	\$20.56	\$119,853,609
9	OH Primary	3 ph	336 ACSR 3ph	5,187,129	7.4%	77.5%	1695	\$81.55	\$422,985,909	\$7.82	\$40,567,501	\$20.56	\$106,671,795
10	OH Primary	3 ph	2/0 ACSR 3ph	2,335,697	3.3%	80.9%	885	\$35.21	\$82,231,022	\$7.82	\$18,267,017	\$20.56	\$48,032,919
11	OH Primary	3 ph	4 ACSR 3ph	1,756,872	2.5%	83.4%	450	\$21.17	\$37,192,973	\$7.82	\$13,740,142	\$20.56	\$36,129,551
12	OH Primary	3 ph	6 CU 3ph	1,294,407	1.8%	85.2%	420	\$10.06	\$13,021,730	\$7.82	\$10,123,295	\$20.56	\$26,619,093
13	OH Primary	3 ph	6A CUWD 3ph	733,392	1.0%	86.3%	420	\$18.70	\$13,713,937	\$7.82	\$5,735,715	\$20.56	\$15,081,999
14	OH Primary	3 ph	1/0 ACSR 3ph	719,893	1.0%	87.3%	780	\$31.76	\$22,864,737	\$7.82	\$5,630,136	\$20.56	\$14,804,379
15	OH Primary	3 ph	4/0 CU 3ph	820,787	1.2%	88.5%	1680	\$40.01	\$32,837,361	\$7.82	\$6,419,214	\$20.56	\$16,879,253
16	OH Primary	3 ph	556 AL 3ph	448,373	0.6%	89.1%	2295	\$104.81	\$46,995,605	\$7.82	\$3,506,634	\$20.56	\$9,220,655
17	OH Primary	3 ph	556 ACSR 3ph	340,521	0.5%	89.6%	2295	\$69.07	\$23,519,500	\$7.82	\$2,663,148	\$20.56	\$7,002,718
18	OH Primary	3 ph	336 AAC 3ph	352,504	0.5%	90.1%	1680	\$74.90	\$26,401,194	\$7.82	\$2,756,862	\$20.56	\$7,249,138
19	OH Primary	3 ph	556 AAC 3ph	<u>244,006</u>	0.3%	90.5%	2295	<u>\$84.45</u>	<u>\$20,607,465</u>	\$7.82	<u>\$1,908,325</u>	\$20.56	<u>\$5,017,920</u>
20	OH Primary	Total 3 Phase Primary in Sample		26,510,914				\$52.99	\$1,404,896,810		\$207,336,559		\$545,189,189
19	OH Primary	Total 1 Ph & 3 Ph OH Primary in Sample		63,316,607				\$32.57	\$2,062,040,882		\$495,186,518		\$1,302,087,470
20									% Customer Related Costs Using Zero Intercept =	24.01%	% Customer Related Costs Using Minimum System =	63.15%	



	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9] = [4] x [8]	[10]	[11] = [4] x [10]	[12]	[13] = [4] x [12]
Line	Property Unit	Phase	Config Details	Conductor Footage/Number Transformers	% of Total Population Footage/ Transformers	Cumulative % of Total Population Footage/ Transformers	Load Carrying Capacity (A, or kVA)	Installed Unit Cost	Total Cost	Y Intercept Minimum Cost per Unit	Total Cost Using Y Intercept Unit Cost	Minimum System Cost per Unit	Total Cost Using Minimum System Cost per Unit
21	OH Secondary		2 ACSR Open Wire	20,338,802	14.9%	14.9%	200	\$6.93	\$140,948,065	\$5.42	\$110,136,646	\$6.51	\$132,308,390
22	OH Secondary		4 ACSR Open Wire	9,718,445	7.1%	22.0%	150	\$5.92	\$57,561,156	\$5.42	\$52,626,352	\$6.51	\$63,220,627
23	OH Secondary		1/0 ACSR Open Wire	18,334,359	13.4%	35.5%	260	\$8.06	\$147,781,520	\$5.42	\$99,282,385	\$6.51	\$119,269,044
24	OH Secondary		6 CU Open Wire	9,845,756	7.2%	42.7%	140	\$6.84	\$67,392,455	\$5.42	\$53,315,751	\$6.51	\$64,048,810
25	OH Secondary		6A CUWD Open Wire	6,296,098	4.6%	47.3%	140	\$6.05	\$38,114,991	\$5.42	\$34,094,002	\$6.51	\$40,957,507
26	OH Secondary		4 CU Open Wire	15,181,580	11.1%	58.4%	185	\$5.66	\$85,909,751	\$5.42	\$82,209,774	\$6.51	\$98,759,525
27	OH Secondary		2 CU Open Wire	14,916,284	10.9%	69.3%	245	\$6.91	\$103,105,077	\$5.42	\$80,773,171	\$6.51	\$97,033,717
28	OH Secondary		1/0 AL Triplex	7,573,248	5.5%	74.9%	205	\$6.51	\$49,265,645	\$5.42	\$41,009,893	\$6.51	\$49,265,645
29	OH Secondary		6 ACSR Duplex	4,852,695	3.6%	78.4%	90	\$6.00	\$29,112,049	\$5.42	\$26,277,828	\$6.51	\$31,567,850
30	OH Secondary		1/0 AL Triplex, Lashed	6,721,759	4.9%	83.4%	205	\$7.46	\$50,146,651	\$5.42	\$36,398,996	\$6.51	\$43,726,522
31	OH Secondary		3/10 CU Open Wire	1,505,128	1.1%	84.5%	165	\$6.31	\$9,498,772	\$5.42	\$8,150,419	\$6.51	\$9,791,189
32	OH Secondary		1/0 CU Open Wire	2,505,605	1.8%	86.3%	300	\$9.11	\$22,837,129	\$5.42	\$13,568,102	\$6.51	\$16,299,513
33	OH Secondary		2 AL Triplex	2,723,553	2.0%	88.3%	150	\$6.34	\$17,260,627	\$5.42	\$14,748,310	\$6.51	\$17,717,310
34	OH Secondary		2/0 ACSR Open Wire	915,530	0.7%	89.0%	295	\$4.86	\$4,449,475	\$5.42	\$4,957,685	\$6.51	\$5,955,723
35	OH Secondary		6 AL Duplex	1,292,144	0.9%	89.9%	90	\$6.25	\$8,078,627	\$5.42	\$6,997,088	\$6.51	\$8,405,680
36	OH Secondary		1/0 AL Open Wire	<u>1,294,876</u>	0.9%	90.9%	265	<u>\$7.06</u>	<u>\$9,135,603</u>	\$5.42	<u>\$7,011,880</u>	\$6.51	<u>\$8,423,451</u>
37		Total OH Secondary in Sample		124,015,860				\$6.78	\$840,597,592		\$671,558,283		\$806,750,504
38										% Customer Related Costs Using Zero Intercept =	79.89%	% Customer Related Costs Using Minimum System =	95.97%

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9] = [4] x [8]	[10]	[11] = [4] x [10]	[12]	[13] = [4] x [12]
Line	Property Unit	Phase	Config Details	Conductor Footage/Number Transformers	% of Total Population Footage/ Transformers	Cumulative % of Total Population Footage/ Transformers	Load Carrying Capacity (A, or kVA)	Installed Unit Cost	Total Cost	Y Intercept Minimum Cost per Unit	Total Cost Using Y Intercept Unit Cost	Minimum System Cost per Unit	Total Cost Using Minimum System Cost per Unit
39	OH Transformers		1 Phase Wye 25 kVA	33,552	29.7%	29.7%	25	\$6,268	\$210,290,392	\$4,582	\$153,728,554	\$5,171	\$173,497,392
40	OH Transformers		1 Phase Wye 10 kVA	17,527	15.5%	45.2%	10	\$5,171	\$90,626,252	\$4,582	\$80,305,209	\$5,171	\$90,632,117
41	OH Transformers		1 Phase Wye 37.5 kVA	15,358	13.6%	58.7%	37.5	\$8,449	\$129,763,828	\$4,582	\$70,367,284	\$5,171	\$79,416,218
42	OH Transformers		1 Phase Wye 15 kVA	17,194	15.2%	73.9%	15	\$4,683	\$80,513,259	\$4,582	\$78,779,469	\$5,171	\$88,910,174
43	OH Transformers		1 Phase Wye 50 kVA	14,750	13.0%	87.0%	50	\$8,169	\$120,489,966	\$4,582	\$67,581,550	\$5,171	\$76,272,250
44	OH Transformers		3 Phase Wye/Wye 75 kVA	1,325	1.2%	88.1%	75	\$8,483	\$11,239,552	\$4,582	\$6,070,885	\$5,171	\$6,851,575
45	OH Transformers		3 Phase Wye/Wye 150 kVA	1,068	0.9%	89.1%	150	\$14,478	\$15,463,035	\$4,582	\$4,893,362	\$5,171	\$5,522,628
46	OH Transformers		3 Phase Wye/Wye 112 kVA	548	0.5%	89.6%	112	\$16,120	\$8,833,592	\$4,582	\$2,510,826	\$5,171	\$2,833,708
47	OH Transformers		3 Phase Wye/Wye 45 kVA	773	0.7%	90.3%	45	\$9,192	\$7,105,570	\$4,582	\$3,541,731	\$5,171	\$3,997,183
48	OH Transformers		1 Phase Wye 100 kVA	<u>657</u>	0.6%	90.8%	100	<u>\$10,829</u>	<u>\$7,114,626</u>	\$4,582	<u>\$3,010,243</u>	\$5,171	<u>\$3,397,347</u>
49	Total OH Transformers in Sample			102,752				\$6,631.89	\$681,440,072		\$470,789,114		\$531,330,592
50										% Customer Related Costs Using Zero Intercept =	69.09%	% Customer Related Costs Using Minimum System =	77.97%
51	UG Primary	1 ph	1/0 AL 1ph	16,024,349	28.7%	28.7%	275	\$26.92	\$431,436,628	\$11.35	\$181,796,240	\$20.88	\$334,525,622
52	UG Primary	1 ph	2 AL 1ph	<u>14,788,376</u>	26.5%	55.1%	225	<u>\$20.88</u>	<u>\$308,723,338</u>	\$11.35	<u>\$167,774,120</u>	<u>\$20.88</u>	<u>\$308,723,338</u>
53	Total 1 Phase Primary in Sample			30,812,725				\$24.02	\$740,159,966		\$349,570,360		\$643,248,960
54													
55	UG Primary	3 ph	1/0 AL 3ph	14,140,772	25.3%	80.4%	645	\$35.34	\$499,721,282	\$11.35	\$160,427,055	\$20.88	\$295,203,907
56	UG Primary	3 ph	750 AL 3ph	4,826,798	8.6%	89.1%	1890	\$64.09	\$309,330,428	\$11.35	\$54,760,018	\$20.88	\$100,764,620
57	UG Primary	3 ph	2 AL 3ph	933,040	1.7%	90.7%	510	\$20.62	\$19,239,291	\$11.35	\$10,585,342	\$20.88	\$19,478,226
58	UG Primary	3 ph	1000 AL 3ph	534,454	1.0%	91.7%	2190	\$71.40	\$38,161,254	\$11.35	\$6,063,383	\$20.88	\$11,157,309
59	UG Primary	3 ph	500 AL 3ph	459,969	0.8%	92.5%	1545	\$36.51	\$16,793,481	\$11.35	\$5,218,352	\$20.88	\$9,602,358
60	UG Primary	3 ph	500 CU 3ph	753,701	1.3%	93.9%	1830	\$108.41	\$81,709,846	\$11.35	\$8,550,735	\$20.88	\$15,734,319
61	UG Primary	3 ph	750 CU 3ph	<u>436,689</u>	0.8%	94.7%	2340	<u>\$96.97</u>	<u>\$42,346,704</u>	\$11.35	<u>\$4,954,235</u>	\$20.88	<u>\$9,116,352</u>
62	Total 3 Phase Primary in Sample			22,085,423				\$44.85	\$990,508,805		\$250,559,120		\$461,057,091
63													
64	Total 1 Ph & 3 Ph UG Primary in Sample			52,898,147					\$1,730,668,771		\$600,129,480		\$1,104,306,051
65										% Customer Related Costs Using Zero Intercept =	34.68%	% Customer Related Costs Using Minimum System =	63.81%

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9] = [4] x [8]	[10]	[11] = [4] x [10]	[12]	[13] = [4] x [12]
Line	Property Unit	Phase	Config Details	Conductor Footage/Number Transformers	% of Total Population Footage/ Transformers	Cumulative % of Total Population Footage/ Transformers	Load Carrying Capacity (A, or kVA)	Installed Unit Cost	Total Cost	Y Intercept Minimum Cost per Unit	Total Cost Using Y Intercept Unit Cost	Minimum System Cost per Unit	Total Cost Using Minimum System Cost per Unit
66	UG Secondary		6 AL Duplex	9,878,341	36.7%	36.7%	90	\$13.62	\$134,523,954	\$10.74	\$106,053,871	\$20.98	\$207,265,507
67	UG Secondary		4/0 AL Triplex	8,355,002	31.0%	67.7%	340	\$23.48	\$196,188,727	\$10.74	\$89,699,304	\$20.98	\$175,303,093
68	UG Secondary		2/0 AL Triplex	2,679,564	10.0%	77.7%	280	\$19.33	\$51,808,384	\$10.74	\$28,767,803	\$20.98	\$56,222,119
69	UG Secondary		1/0 AL Triplex	1,460,657	5.4%	83.1%	220	\$20.98	\$30,647,236	\$10.74	\$15,681,615	\$20.98	\$30,647,236
70	UG Secondary		6 CU Open Wire	1,206,909	4.5%	87.6%	140	\$12.90	\$15,564,876	\$10.74	\$12,957,378	\$20.98	\$25,323,146
71	UG Secondary		350 AL Triplex	<u>660,658</u>	2.5%	90.1%	450	<u>\$23.91</u>	<u>\$15,799,054</u>	\$10.74	<u>\$7,092,828</u>	\$20.98	<u>\$13,861,809</u>
72		Total UG Secondary in Sample		24,241,133				\$18.34	\$444,532,232		\$260,252,800		\$508,622,909
73										% Customer Related Costs Using Zero Intercept =	58.55%	% Customer Related Costs Using Minimum System =	100.00%
74	UG Transformers		1 Phase Wye 50 kVA	31,125	35.4%	35.4%	50	\$8,630	\$268,614,731	\$8,559	\$266,392,650	\$8,137	\$253,272,440
75	UG Transformers		1 Phase Wye 25 kVA	17,418	19.8%	55.2%	25	\$2,129	\$37,087,596	\$8,559	\$149,077,178	\$8,137	\$141,734,919
76	UG Transformers		1 Phase Wye 37.5 kVA	8,619	9.8%	65.0%	37.5	\$12,182	\$104,994,055	\$8,559	\$73,768,297	\$8,137	\$70,135,106
77	UG Transformers		3 Phase Wye/Wye 150 kVA	3,986	4.5%	69.6%	150	\$26,857	\$107,053,066	\$8,559	\$34,115,377	\$8,137	\$32,435,147
78	UG Transformers		3 Phase Wye/Wye 300 kVA	3,834	4.4%	73.9%	300	\$31,548	\$120,955,892	\$8,559	\$32,814,439	\$8,137	\$31,198,282
79	UG Transformers		3 Phase Wye/Wye 75 kVA	3,656	4.2%	78.1%	75	\$23,569	\$86,170,049	\$8,559	\$31,290,973	\$8,137	\$29,749,849
80	UG Transformers		3 Phase Wye/Wye 500 kVA	3,255	3.7%	81.8%	500	\$34,818	\$113,331,005	\$8,559	\$27,858,894	\$8,137	\$26,486,805
81	UG Transformers		1 Phase Wye 15 kVA	2,258	2.6%	84.4%	15	\$8,137	\$18,373,949	\$8,559	\$19,325,770	\$8,137	\$18,373,949
82	UG Transformers		3 Phase Wye/Wye 112 kVA	1,932	2.2%	86.6%	112	\$7,217	\$13,942,448	\$8,559	\$16,535,602	\$8,137	\$15,721,200
83	UG Transformers		3 Phase Wye/Wye 225 kVA	1,752	2.0%	88.5%	225	\$8,446	\$14,798,075	\$8,559	\$14,995,018	\$8,137	\$14,256,492
84	UG Transformers		3 Phase Wye/Wye 750 kVA	<u>1,954</u>	2.2%	90.8%	750	<u>\$44,930</u>	<u>\$87,792,569</u>	\$8,559	<u>\$16,723,895</u>	\$8,137	<u>\$15,900,220</u>
85		Total UG Transformers in Sample		79,789				\$12,196.09	\$973,113,435		\$682,898,093		\$649,264,409
86										% Customer Related Costs Using Zero Intercept =	70.18%	% Customer Related Costs Using Minimum System =	66.72%
87		Total OH and UG Transformors in Sample		182,541				\$9,064	\$1,654,553,506		\$1,153,687,207		\$1,180,595,001
88										% Customer Related Costs Using Zero Intercept =	69.73%	% Customer Related Costs Using Minimum System =	71.35%

		[1]	[2]	[3] = [1] x [2]	[4] = % of Line 11	[5] = [Col 5 Line 11 - Line 10] x [4]	[6] = (Customer % from Attachment N)	[7]	[8]
<u>Line</u>	<u>Overhead Distribution Plant</u>	<u>Total Footage</u>	<u>Average Cost per Foot</u>	<u>Total Replacement Cost (\$000)</u>	<u>% of Total Replacement Cost</u>	<u>Test Year Plant in Service (\$000)</u>	<u>% Customer or Capacity Related</u>	<u>Final Test Year Plant in Service (\$000)</u>	<u>% of Total Overhead Dist Costs</u>
1	OH Primary Single Phase Capacity						75.99%	\$25,947	16.61%
2	<u>OH Primary Single Phase Customer</u>						<u>24.01%</u>	<u>\$8,200</u>	5.25%
3	Total OH Primary Single Phase	40,232,843	\$17.85	\$718,334	22.31%	\$34,147	100.00%	\$34,147	
4	OH Primary Multi Phase Capacity						75.99%	\$56,967	36.46%
5	<u>OH Primary Multi Phase Customer</u>						<u>24.01%</u>	<u>\$18,004</u>	11.52%
6	Total OH Primary Multi Phase	29,760,732	\$52.99	\$1,577,115	48.97%	\$74,971	100.00%	\$74,971	
7	OH Secondary Capacity						20.11%	\$8,842	5.66%
8	<u>OH Secondary Customer</u>						<u>79.89%</u>	<u>\$35,129</u>	22.49%
9	Total OH Secondary	136,467,174	\$6.78	\$924,994	28.72%	\$43,971	100.00%	\$43,971	
10	Street Lighting (see Line 9 of Schedule XX)					\$3,135		\$3,135	2.01%
11	Total Overhead (see Schedule X, Page 4, Column 1, Line XX)			\$3,220,443	100.00%	\$156,226		\$156,226	100.00%

		[1]	[2]	[3] = [1] x [2]	[4] = % of Line 22	[5] = [Col 5 Line 22 - Line 21] x [4]	[6] = (Customer % from Attachment N)	[7]	[8]
	<u>Underground Distribution Plant</u>	<u>Total Footage</u>	<u>Average Cost per Foot</u>	<u>Total Replacement Cost (\$000)</u>	<u>% of Total Replacement Cost</u>	<u>Test Year Plant in Service (\$000)</u>	<u>% Customer or Capacity Related</u>	<u>Final Test Year Plant in Service (\$000)</u>	<u>% of Total Underground Distr Costs</u>
12	UG Primary Single Phase Capacity						65.32%	\$46,801	21.10%
13	<u>UG Primary Single Phase Customer</u>						<u>34.68%</u>	<u>\$24,844</u>	11.20%
14	Total UG Primary Single Phase	31,519,114	\$24.02	\$757,128	32.31%	\$71,645	100.00%	\$71,645	
15	UG Primary Multi Phase Capacity						65.32%	\$67,546	30.46%
16	<u>UG Primary Multi Phase Customer</u>						<u>34.68%</u>	<u>\$35,856</u>	16.17%
17	Total UG Primary Multi Phase	24,364,721	\$44.85	\$1,092,733	46.63%	\$103,402	100.00%	\$103,402	
18	UG Secondary Capacity						41.45%	\$19,364	8.73%
19	<u>UG Secondary Customer</u>						<u>58.55%</u>	<u>\$27,348</u>	12.33%
20	Total UG Secondary	26,919,485	\$18.34	\$493,648	21.06%	\$46,712	100.00%	\$46,712	
21	Street Lighting					\$0		\$0	0.00%
22	Total Underground			\$2,343,509	100.00%	\$221,759		\$221,759	100.00%

		[1]	[2]	[3] = [1] x [2]	[4] = % of Line 27	[5] = [Col 5 Line 27] x [4]	[6] = (Customer % from Attachment N)	[7]	[8]
	<u>Transformers</u>	<u>Number of Transformers</u>	<u>Average Cost Per Transformer</u>	<u>Total Replacement Cost (\$000)</u>	<u>% of Total Replacement Cost</u>	<u>Test Year Plant in Service (\$000)</u>	<u>% Customer or Capacity Related</u>	<u>Final Test Year Plant in Service (\$000)</u>	<u>% of Total Transformer Costs</u>
23	Primary	1,369	\$161,643	\$221,289	17.75%	\$8,769	100% Capacity	\$8,769	17.75%
24	Secondary Capacity						31.95%	\$12,979	26.28%
25	Secondary Customer						<u>68.05%</u>	<u>\$27,647</u>	<u>55.97%</u>
26	Total Secondary	113,110	\$9,064	\$1,025,230	82.25%	\$40,626	100.00%	\$40,626	82.25%
27	Total Transformers			\$1,246,520	100.00%	\$49,394		\$49,394	100.00%

Northern States Power Company  
Minimum System Analysis for Distribution Services

Docket No. EL25-\_\_\_\_  
Exhibit\_\_\_\_(CJB-1), Schedule 6  
Attachment P - Page 1 of 1

[1]		[2]	[3]	[4]	[5]	[6] = [3] x [4] x [5] / 1000	[7]	[8] = [6] / [7]	[9] = 1 - [8]
<u>Services</u>		<u>Minimum Conductor Configuration</u>	<u>Minimum Footage per Service</u>	<u>Installed Cost per Foot</u>	<u>Number of Customers</u>	<u>Total Minimum Installed Cost (\$000)</u>	<u>Test Year Plant Investment Distribution Services (\$000)</u>	<u>Customer Component Distribution Services</u>	<u>Capacity Component Distribution Services</u>
1	OH Services	2 ACSR Triplex	50	\$4.03	47,764	\$9,625			
2	<u>UG Services</u>	1/0 Triplex	50	\$2.81	<u>42,201</u>	<u>\$5,929</u>			
3	Total Services				89,966	\$15,554	\$43,493	35.76%	64.24%