

**Nueces Electric Cooperative, Inc. (NEC)
2023 Distribution Loss Factor Calculation Summary**

The following summary contains the methods used to develop the adjusting factors for use in calculating Nueces Electric Cooperative, Inc (NEC) loss adjustments to be applied to load profiles as per ERCOT protocols. These factors apply to 2023 intervals.

ERCOT protocols include the following equation for the factor to be applied to each 15-minute interval of day ahead profiled load.

$$SILFi = F1 * (SIELi / AAL) + F2 + F3 / (SIELi / AAL)$$

Where,

SILFi = Settlement Interval Distribution Loss Factor

SIELi = Settlement Interval ERCOR Load

AAL = Annual Interval Average ERCOT System Load

F1, F2, & F3 = Coefficients derived from regression analysis of the TDSP loss study results.

and where,

AAL = Annual ERCOT Total System MWH / Total annual intervals
= 12,450 (to be used for 2023 loss calculations)

Comparing NEC and ERCOT Demand Profiles

Values for 2023

ERCOT Peak MW = 85,579

Peak Date & Time = 8/10/2023 @ IE 17:00

ERCOT Annual MWH = 436,232,829

Annual Interval Average ERCOT System Load = 12,450

NEC Values

NEC 2023 Peak (MW) = 83.03

NEC AAL (15-min intervals) MWH = 37.54

NEC had an overall peak of 172.97 MW; however, 89.94 MW of demand was metered on the primary side of substation transformer. The peak to be used for the Distribution Loss Calculation will be 83.03 MW.

	<u>15 mins</u>	<u>1 hour</u>
NEC Demand at ERCOT Peak (MW)	20.76	83.03
NEC AAL (MWH)	9.39	37.54
ERCOT Peak (MW)	21,395	85,579
ERCOT AAL (MWH)	12,450	49,800

The ratio of NEC Peak to AAL is proportionate to ERCOT’s with the ratio of both being 1.71. So for this analysis we can assume NEC and ERCOT demand correlate.

Methodology for Losses

NEC wire loads have been compensated for all substation transformer losses. Distribution primary conductor losses, distribution transformer losses and secondary conductor losses were calculated based on load levels using the following equation:

$$\begin{aligned}
 \text{Losses} &= AX^2 + B \\
 A &= \text{Constant} \\
 B &= \text{Constant (No – Load Losses)} \\
 X &= \text{Input to System (MW)}
 \end{aligned}$$

The equation was solved for the A constant for each potential loss level in the distribution system. With the A constant for each level, losses can be determined based on the input to the system.

Primary Conductor

NEC uses Milsoft Engineering Analysis – Windmil modeling software to find primary conductor losses on every substation distribution feeder. kW demands are entered into each substation at a specific time to find line losses at that time with given load. The time used was 08/10/2023 17:00, ERCOT’s 2023 time of Peak demand. Line losses were calculated to be 3.68MW.

Distribution Transformers

NEC’s GIS model contained 21,802 transformers with most of them being single phase transformers. Averages and typical losses of transformers were used to find total losses of 1.53 MW.

Secondary Conductor

An average load per customer was calculated for single phase and three phase services. An assumed service length and resistance of service was determined to find secondary line loss. 0.083 MW.

NEC Customer Coding

NEC customers are divided into two groups, ‘A’ & ‘B’. A group customers are primary metered at medium voltage with respect to distribution transformer. B group customers are secondary metered with respect to distribution transformers. F1, F2, & F3 were selected to match the curve of losses calculated based on system data.

Group A Coefficients:	F1 = 0.0234	F2 = 0.000141	F3 = 0.00012
Group B Coefficients:	F1 = 0.0256	F2 = 0.000120	F3 = 0.02500

Distribution Loss Factor Results

Group A Customers - Primary		Group B Customers - Secondary	
DLF at AAL	DLF at Peak	DLF at AAL	DLF at Peak
2.37%	5.86%	5.07%	7.41%

Loss Calculations

The equation from page 2 re-arranged to solve for A:

$$A = \frac{\text{Losses} - B}{X^2}$$

Primary Conductor

Total Losses = 3.68 MW

No Load Losses = 0 MW

Input = 83.03 MW

$$A = \frac{3.68 - 0}{83.03^2}$$

$A = 5.342E-4$

$B = 0$

Distribution Transformer

Total Losses = 1.53MW

No Load Losses = 1.399 MW

Input = 79.347 MW

$$A = \frac{1.53 - 1.399}{79.347^2}$$

$A = 2.00E-5$

$B = 1.399$

Secondary Conductor

Total Losses = 0.083 MW

No Load Losses = 0 MW

Input = 77.82 MW

$$A = \frac{0.083 - 0}{77.82^2}$$

$A = 1.2974E-5$

$B = 0$

NEC Distribution Load Factor Table

	ERCOT Load (1 hr)	ERCOT Interval Load SIEL (15 min)	NEC Load	NEC Interval Load	Primary Conductor Losses	Primary Losses %	Input to Dist Trfs	Dist Trf Losses	Input to Secondary	Secondary Conductor Losses	Total Losses	Total Losses	DLF Secondary	DLF Primary	
	MW	MW	MW	MW	MW		MW	MW	MW	MW	MW	MW			
	6,027	1,507	4.54	1.14	0.01	0.24%	4.53	1.09	3.45	0.00	1.10	24.22%	20.98%	0.40%	
	10,006	2,502	7.54	1.89	0.03	0.40%	7.51	1.09	6.43	0.00	1.12	14.89%	12.97%	0.54%	
	13,986	3,496	10.54	2.64	0.06	0.56%	10.48	1.09	9.39	0.01	1.16	10.97%	9.63%	0.71%	
	17,965	4,491	13.54	3.39	0.10	0.72%	13.45	1.10	12.35	0.01	1.20	8.87%	7.87%	0.89%	
	21,945	5,486	16.54	4.14	0.15	0.88%	16.40	1.10	15.29	0.01	1.26	7.60%	6.81%	1.07%	
	25,924	6,481	19.54	4.89	0.20	1.04%	19.34	1.11	18.23	0.01	1.32	6.77%	6.15%	1.26%	
	29,903	7,476	22.54	5.64	0.27	1.20%	22.27	1.12	21.15	0.01	1.40	6.22%	5.71%	1.44%	
	33,883	8,471	25.54	6.39	0.35	1.36%	25.20	1.13	24.07	0.01	1.49	5.84%	5.43%	1.62%	
	37,862	9,465	28.54	7.14	0.44	1.52%	28.11	1.14	26.97	0.02	1.59	5.57%	5.25%	1.81%	
	41,841	10,460	31.54	7.89	0.53	1.69%	31.01	1.15	29.86	0.02	1.70	5.40%	5.14%	1.99%	
	45,821	11,455	34.54	8.64	0.64	1.85%	33.91	1.16	32.74	0.02	1.82	5.28%	5.08%	2.18%	
ERCOT AAL	49,800	12,450	37.54	9.39	0.75	2.01%	36.79	1.18	35.61	0.03	1.96	5.21%	5.07%	2.37%	ERCOT AAL
	53,779	13,445	40.54	10.14	0.88	2.17%	39.67	1.19	38.47	0.03	2.10	5.18%	5.09%	2.55%	
	57,759	14,440	43.54	10.89	1.01	2.33%	42.53	1.21	41.32	0.03	2.26	5.18%	5.14%	2.74%	
	61,738	15,435	46.54	11.64	1.16	2.49%	45.39	1.23	44.16	0.04	2.42	5.21%	5.20%	2.92%	
	65,717	16,429	49.54	12.39	1.31	2.65%	48.23	1.25	46.99	0.04	2.60	5.25%	5.28%	3.11%	
	69,697	17,424	52.54	13.14	1.47	2.81%	51.07	1.27	49.80	0.05	2.79	5.31%	5.38%	3.30%	
	73,676	18,419	55.54	13.89	1.65	2.97%	53.90	1.29	52.61	0.05	2.99	5.38%	5.49%	3.48%	
	77,655	19,414	58.54	14.64	1.83	3.13%	56.71	1.31	55.40	0.06	3.20	5.46%	5.61%	3.67%	
	81,635	20,409	61.54	15.39	2.02	3.29%	59.52	1.33	58.19	0.06	3.42	5.55%	5.73%	3.86%	
	85,614	21,404	64.54	16.14	2.23	3.45%	62.32	1.36	60.96	0.07	3.65	5.65%	5.87%	4.04%	
	89,594	22,398	67.54	16.89	2.44	3.61%	65.11	1.38	63.73	0.07	3.89	5.76%	6.01%	4.23%	
	93,573	23,393	70.54	17.64	2.66	3.77%	67.89	1.41	66.48	0.08	4.14	5.88%	6.15%	4.42%	
97,552	24,388	73.54	18.39	2.89	3.93%	70.65	1.43	69.22	0.09	4.41	5.99%	6.30%	4.60%		
101,532	25,383	76.54	19.14	3.13	4.09%	73.41	1.46	71.95	0.09	4.68	6.12%	6.46%	4.79%		
ERCOT Peak	124,408	31,102	93.79	23.45	4.70	5.01%	89.09	1.64	87.45	0.13	6.47	6.90%	7.41%	5.86%	ERCOT Peak
	131,040	32,760	98.79	24.70	5.21	5.28%	93.58	1.70	91.88	0.15	7.06	7.15%	7.70%	6.18%	
	137,672	34,418	103.79	25.95	5.75	5.54%	98.04	1.76	96.28	0.16	7.67	7.39%	7.99%	6.49%	
	144,305	36,076	108.79	27.20	6.32	5.81%	102.47	1.82	100.65	0.18	8.32	7.65%	8.29%	6.80%	
	150,937	37,734	113.79	28.45	6.92	6.08%	106.87	1.88	104.99	0.19	8.99	7.90%	8.60%	7.11%	
	157,569	39,392	118.79	29.70	7.54	6.35%	111.25	1.95	109.30	0.21	9.70	8.16%	8.90%	7.42%	
	164,201	41,050	123.79	30.95	8.19	6.61%	115.60	2.02	113.58	0.22	10.43	8.43%	9.21%	7.73%	

ERCOT Load (1 hr)	ERCOT Interval Load SIEL (15 min)	NEC Load (1 hr)	NEC Interval Load (15 min)									DLF Secondary		DLF Primary		
49,800	12,450	37.54	9.39	0.43	1.19%	35.51	1.11	34.40	0.02	1.57	4.36%	5.07%	398.00%	At ERCOT AAL		
85,579	21,395	83.03	20.76	2.92	3.11%	90.87	1.28	29.59	0.14	4.33	4.62%	7.65%	6.12%	At ERCOT Peak		

AAL
Peak

ERCOT		NEC	
1 Hour	15 min	1 Hour	15 min
49,800	12,450	37.54	9.39
85,579	21,395	93.79	23.45

Group B - Secondary Coefficients		
F1	F2	F3
0.0256	0.00012	0.025

Group A - Primary Coefficients		
F1	F2	F3
0.0234	0.0001411	0.00012

	Prim Conductor	Dist Trf	Sec Conductor
A Constant	0.000534234	7.00E-05	1.70648E-05
B Constant	0.00	1.084	0.00

2023 Nueces Electric Cooperative 'A' Customers Distribution Loss Factors



