

**Nueces Electric Cooperative, Inc. (NEC)  
2021 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 2019 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,

$$\begin{aligned} AAL &= \text{Annual ERCOT Total System MWH} / \text{Total annual intervals} \\ &= 10,801 \text{ (to be used for 2021 loss calculations)} \end{aligned}$$

**Comparing NEC and ERCOT Demand Profiles**

ERCOT Values for 2021

ERCOT Annual MWH = 392,847,979

ERCOT AAL (15-min intervals) MWH = 10,801

ERCOT Peak MW = 73,822

Peak Date = 8/24/2021 17:00

NEC Values

NEC 2021 Peak (MW) = 93.79

NEC AAL (15-min intervals) MWH = 23.45

NEC had an overall peak of 182.35 MW, however 88.56 MW of demand was metered on primary side of substation transformer. The peak to be used for the Distribution Loss Calculation will be 93.79 MW

	<b><u>15 mins</u></b>	<b><u>1 hour</u></b>
NEC Peak (MW)	23.45	93.79
NEC AAL (MWH)	8.99	35.94
ERCOT Peak (MW)	18,456	73,822
ERCOT AAL (MWH)	11,211	44,844

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 08/24/2021 17:00, ERCOT's 2021 time of Peak demand. Line losses were calculated to be 3.68MW.

### Distribution Transformers

NEC's GIS model contained 17,816 transformers with most of them being single phase transformers. Averages and typical losses of transformers were used to find total losses of 1.28 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. 0.137MW

## **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%	6.12%	5.07%	7.65%

## 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 = 93.79 MW*

$$A = \frac{3.68 - 0}{93.79^2}$$

$$A = 4.32E-4$$

$$B = 0$$

### Distribution Transformer

*Total Losses = 1.28MW*

*No Load Losses = 1.084 MW*

*Input = 90.107 MW*

$$A = \frac{1.28 - 1.084}{90.107^2}$$

$$A = 2.38E-5$$

$$B = 1.084$$

### Secondary Conductor

*Total Losses = 0.137 MW*

*No Load Losses = 0 MW*

*Input = 88.83 MW*

$$A = \frac{0.137 - 0}{88.83^2}$$

$$A = 1.685E-5$$

$$B = 0$$

NEC Distribution Load Factor Table

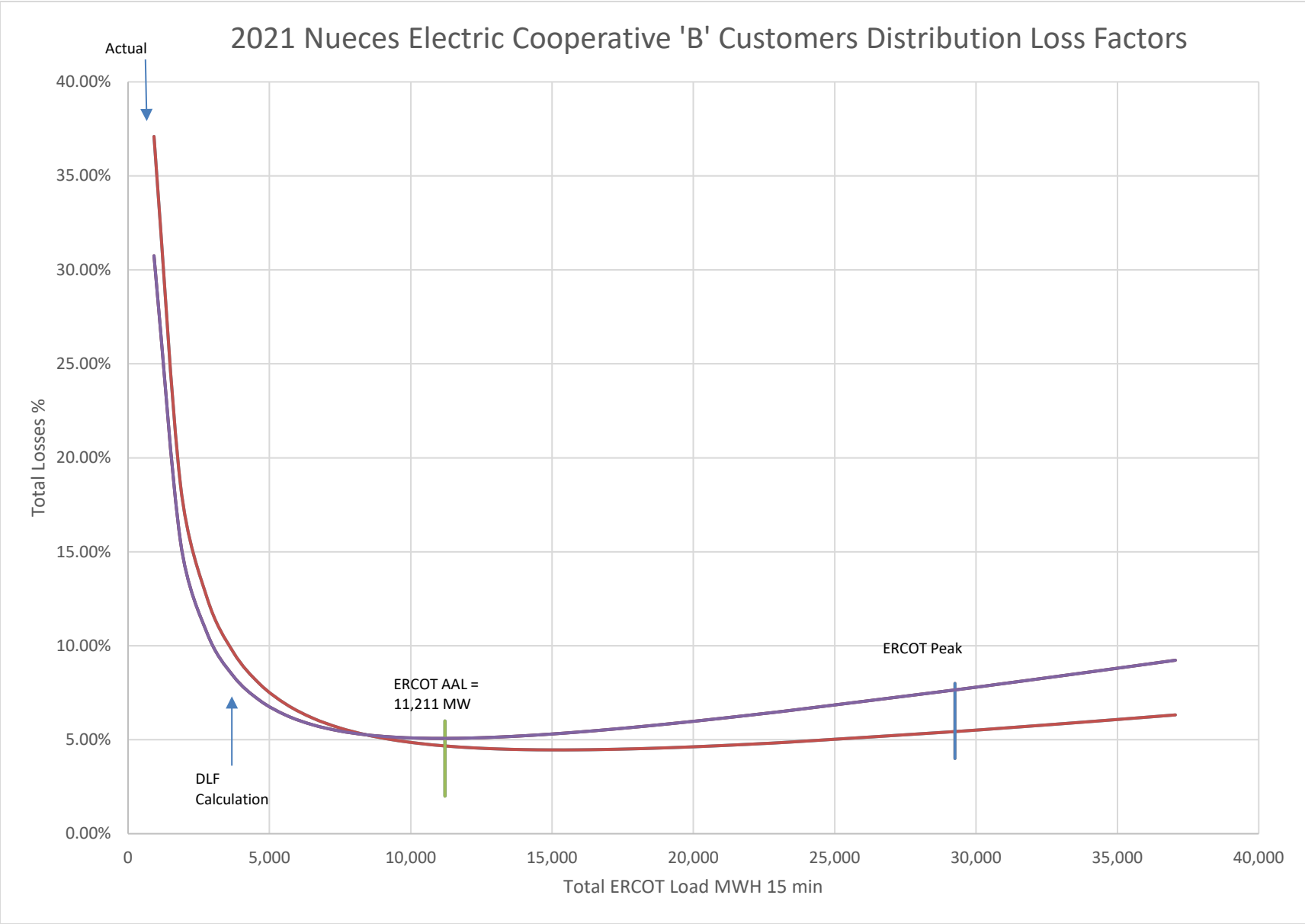
	ERCOT	ERCOT Interval	NEC Load	NEC Interval	Primary	Primary Losses	Input to Dist	Dist Trf	Input to	Secondary	Total Losses	Total Losses	DLF Secondary	DLF Primary		
	Load (1 hr)	Load SIEL (15 min)		Load	Conductor	%	Trfs	Losses	Secondary	Conductor Losses						
	MW	MW		MW	MW	MW	MW	MW	MW	MW						
	3,672	918	2.94	0.74	0.00	0.12%	2.94	1.08	1.86	0.00	1.09	37.10%	30.75%	0.35%		
	7,415	1,854	5.94	1.49	0.01	0.25%	5.93	1.08	4.84	0.00	1.10	18.58%	15.55%	0.47%		
	11,158	2,790	8.94	2.24	0.03	0.37%	8.91	1.09	7.82	0.01	1.12	12.57%	10.70%	0.64%		
	14,901	3,725	11.94	2.99	0.06	0.50%	11.88	1.09	10.80	0.01	1.15	9.65%	8.39%	0.83%		
	18,644	4,661	14.94	3.74	0.09	0.63%	14.85	1.09	13.76	0.01	1.19	7.96%	7.09%	1.02%		
	22,387	5,597	17.94	4.49	0.13	0.75%	17.81	1.09	16.72	0.01	1.24	6.88%	6.30%	1.21%		
	26,130	6,532	20.94	5.24	0.18	0.88%	20.76	1.09	19.67	0.01	1.29	6.15%	5.79%	1.40%		
	29,872	7,468	23.94	5.99	0.24	1.00%	23.70	1.10	22.61	0.01	1.35	5.64%	5.47%	1.59%		
	33,615	8,404	26.94	6.74	0.30	1.13%	26.64	1.10	25.54	0.01	1.42	5.27%	5.27%	1.78%		
	37,358	9,340	29.94	7.49	0.38	1.25%	29.57	1.10	28.46	0.02	1.50	5.00%	5.15%	1.98%		
	41,101	10,275	32.94	8.24	0.45	1.38%	32.49	1.11	31.38	0.02	1.58	4.81%	5.09%	2.17%		
	ERCOT AAL	44,844	11,211	35.94	8.99	0.54	1.50%	35.40	1.11	34.29	0.02	1.68	4.67%	5.07%	2.37%	ERCOT AAL
	48,587	12,147	38.94	9.74	0.63	1.63%	38.31	1.12	37.19	0.03	1.78	4.57%	5.09%	2.56%		
	52,330	13,082	41.94	10.49	0.74	1.76%	41.21	1.12	40.08	0.03	1.89	4.51%	5.14%	2.76%		
	56,073	14,018	44.94	11.24	0.85	1.88%	44.10	1.13	42.97	0.04	2.01	4.47%	5.21%	2.95%		
	59,816	14,954	47.94	11.99	0.96	2.01%	46.98	1.14	45.84	0.04	2.14	4.46%	5.30%	3.14%		
	63,558	15,890	50.94	12.74	1.09	2.13%	49.86	1.14	48.71	0.04	2.27	4.46%	5.40%	3.34%		
	67,301	16,825	53.94	13.49	1.22	2.26%	52.73	1.15	51.58	0.05	2.42	4.48%	5.52%	3.53%		
	71,044	17,761	56.94	14.24	1.36	2.38%	55.59	1.16	54.43	0.05	2.57	4.51%	5.65%	3.73%		
	74,787	18,697	59.94	14.99	1.50	2.51%	58.44	1.17	57.27	0.06	2.73	4.55%	5.78%	3.92%		
	78,530	19,632	62.94	15.74	1.66	2.64%	61.28	1.17	60.11	0.06	2.90	4.60%	5.92%	4.12%		
	82,273	20,568	65.94	16.49	1.82	2.76%	64.12	1.18	62.94	0.07	3.07	4.66%	6.07%	4.31%		
	86,016	21,504	68.94	17.24	1.99	2.89%	66.95	1.19	65.76	0.08	3.26	4.72%	6.23%	4.51%		
	89,759	22,440	71.94	17.99	2.17	3.01%	69.78	1.20	68.58	0.08	3.45	4.80%	6.39%	4.70%		
93,501	23,375	74.94	18.74	2.35	3.14%	72.59	1.21	71.38	0.09	3.65	4.87%	6.55%	4.90%			
ERCOT Peak	117,015	29,254	93.79	23.45	3.68	3.93%	90.11	1.28	88.83	0.14	5.10	5.43%	7.65%	6.12%	ERCOT Peak	
	123,253	30,813	98.79	24.70	4.09	4.14%	94.70	1.30	93.41	0.15	5.53	5.60%	7.96%	6.45%		
	129,491	32,373	103.79	25.95	4.51	4.35%	99.28	1.32	97.96	0.17	5.99	5.78%	8.27%	6.78%		
	135,729	33,932	108.79	27.20	4.96	4.55%	103.83	1.34	102.49	0.18	6.48	5.95%	8.59%	7.10%		
	141,968	35,492	113.79	28.45	5.42	4.76%	108.37	1.36	107.01	0.20	6.98	6.14%	8.91%	7.43%		
	148,206	37,051	118.79	29.70	5.91	4.97%	112.88	1.39	111.50	0.21	7.51	6.32%	9.23%	7.75%		
	154,444	38,611	123.79	30.95	6.42	5.18%	117.37	1.41	115.96	0.23	8.06	6.51%	9.55%	8.08%		
ERCOT	ERCOT Interval	NEC Load	NEC Interval											DLF Secondary	DLF Primary	
Load (1 hr)	Load SIEL (15 min)	(1 hr)	Load (15 min)													
44,844	11,211	35.94	8.99	0.43	1.19%	35.51	1.11	34.40	0.02	1.57	4.36%	5.07%	2.37%	At ERCOT AAL		
117,015	29,254	93.79	23.45	2.92	3.11%	90.87	1.28	29.59	0.14	4.33	4.62%	7.65%	6.12%	At ERCOT Peak		

ERCOT		NEC	
1 Hour	15 min	1 Hour	15 min
44,844	11,211	35.94	8.99
73,822	18,456	93.79	23.45

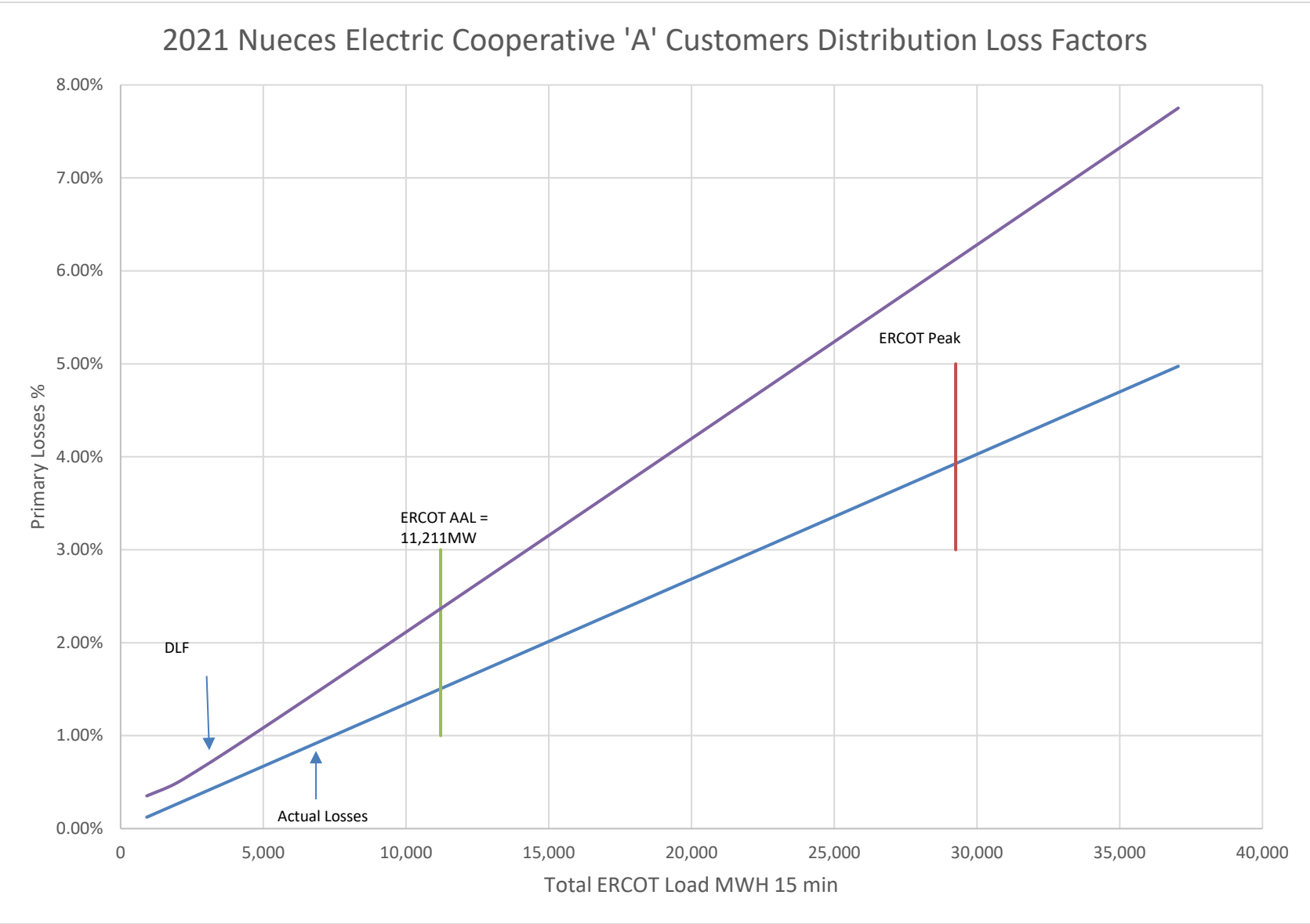
Group B - Secondary Coefficients		
F1	F2	F3
0.0256	0.00012	0.025

Group A - Primary Coefficients		
F1	F2	F3
0.0234	0.0001411	0.00012

	Prim Conductor	Dist Trf	Sec Conductor
A Constant	0.000418686	2.38E-05	1.68519E-05
B Constant	0.00	1.084	0.00



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