Nueces Electric Cooperative, Inc. (NEC)
2019 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,

AAL = Annual ERCOT Total System MWH / Total annual intervals
= 10,708 (to be used for 2019 loss calculations)

Comparing NEC and ERCOT Demand Profiles

ERCOT Values for 2019
ERCOT Annual MWH = 375,191,874
ERCOT AAL (15-min intervals) MWH = 10,708
ERCOT Peak MW = 73,308
Peak Date = 7/19/2018 17:00

NEC Values
NEC 2018 Peak (MW) = 72.53
NEC AAL (15-min intervals) MWH = 10.59

NEC had an overall peak of 144.5 MW; however 71.97 MW of demand was metered on primary side of substation transformer. The peak to be used for the Distribution Loss Calculation will be 72.53.

	15 mins	**1 hour**
NEC Peak (MW)	18.13	72.53
NEC AAL (MWH)	10.59	42.37
ERCOT Peak (MW)	18,327	73,308
ERCOT AAL (MWH)	10,708	42,832

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:

$$Losses = AX^2 + B$$
$$A = Constant$$
$$B = Constant\ (No - Load\ Losses)$$
$$X = Input\ to\ System\ (MW)$$

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 7/19/2018 17:00, ERCOT's 2018 time of Peak demand. Line losses were calculated to be 2.921MW.

Distribution Transformers

NEC's GIS model contained 16,771 transformers with most of them being single phase transformers. Averages and typical losses of transformers were used to find total losses of 1.207 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.

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%	4.03%	5.07%	5.85%

Loss Calculations

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

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

Primary Conductor
$Total\ Losses = 2.92\ MW$
$No\ Load\ Losses\ = 0\ MW$
$Input = 72.53\ MW$
$$A = \frac{2.92 - 0}{72.53^2}$$

$A = 5.553E\text{-}4$
$B = 0$

Distribution Transformer
$Total\ Losses = 1.21MW$
$No\ Load\ Losses\ = 1.084\ MW$
$Input = 69.61\ MW$
$$A = \frac{1.21 - 1.084}{69.61^2}$$

$A = 2.550E\text{-}5$
$B = 1.084$

Secondary Conductor
$Total\ Losses = 0.082\ MW$
$No\ Load\ Losses\ = 0\ MW$
$Input = 68.40\ MW$
$$A = \frac{0.082 - 0}{68.40^2}$$

$A = 1.665E\text{-}5$
$B = 0$

NEC Distribution Load Factor Table

ERCOT Load (1 hr) MW	ERCOT Interval Load SIEL (15 min) MW	NEC Load MW	NEC Interval Load MW	Primary Conductor Losses MW	Primary Losses %	Input to Dist Trfs MW	Dist Trf Losses MW	Input to Secondary MW	Secondary Conductor Losses MW	Total Losses MW	Total Losses	DLF Secondary	DLF Primary	
9,475	2,369	9.37	2.34	0.05	0.52%	9.32	1.09	8.24	0.01	1.14	12.16%	11.88%	0.59%	
12,507	3,127	12.37	3.09	0.09	0.69%	12.29	1.09	11.20	0.01	1.18	9.53%	9.32%	0.74%	
15,540	3,885	15.37	3.84	0.13	0.85%	15.24	1.09	14.15	0.01	1.23	7.99%	7.83%	0.90%	
18,572	4,643	18.37	4.59	0.19	1.02%	18.19	1.09	17.09	0.01	1.29	7.01%	6.89%	1.06%	
21,605	5,401	21.37	5.34	0.25	1.19%	21.12	1.10	20.02	0.01	1.36	6.36%	6.26%	1.22%	
24,637	6,159	24.37	6.09	0.33	1.35%	24.04	1.10	22.94	0.01	1.44	5.91%	5.83%	1.38%	
27,670	6,917	27.37	6.84	0.42	1.52%	26.96	1.10	25.85	0.02	1.53	5.60%	5.54%	1.54%	
30,702	7,676	30.37	7.59	0.51	1.69%	29.86	1.11	28.75	0.02	1.64	5.39%	5.33%	1.71%	
33,735	8,434	33.37	8.34	0.62	1.85%	32.75	1.11	31.64	0.02	1.75	5.25%	5.20%	1.87%	
36,767	9,192	36.37	9.09	0.73	2.02%	35.64	1.12	34.52	0.02	1.87	5.15%	5.12%	2.04%	
39,800	9,950	39.37	9.84	0.86	2.19%	38.51	1.12	37.39	0.03	2.01	5.10%	5.08%	2.20%	
42,832	10,708	42.37	10.59	1.00	2.35%	41.38	1.13	40.25	0.03	2.16	5.09%	5.07%	2.37%	ERCOT AAL
45,864	11,466	45.37	11.34	1.14	2.52%	44.23	1.13	43.10	0.03	2.31	5.10%	5.09%	2.53%	
48,897	12,224	48.37	12.09	1.30	2.69%	47.07	1.14	45.93	0.04	2.48	5.12%	5.12%	2.70%	
51,929	12,982	51.37	12.84	1.47	2.85%	49.91	1.15	48.76	0.04	2.66	5.17%	5.18%	2.86%	
54,962	13,740	54.37	13.59	1.64	3.02%	52.73	1.15	51.58	0.05	2.84	5.23%	5.25%	3.03%	
57,994	14,499	57.37	14.34	1.83	3.19%	55.55	1.16	54.38	0.05	3.04	5.31%	5.32%	3.19%	
61,027	15,257	60.37	15.09	2.02	3.35%	58.35	1.17	57.18	0.06	3.25	5.39%	5.41%	3.36%	
64,059	16,015	63.37	15.84	2.23	3.52%	61.14	1.18	59.96	0.06	3.47	5.48%	5.51%	3.52%	
67,092	16,773	66.37	16.59	2.45	3.69%	63.93	1.19	62.74	0.07	3.70	5.58%	5.62%	3.69%	
70,124	17,531	69.37	17.34	2.67	3.85%	66.70	1.20	65.50	0.08	3.95	5.69%	5.73%	3.85%	
73,157	18,289	72.37	18.09	2.91	4.02%	69.46	1.21	68.26	0.08	4.20	5.80%	5.85%	4.02%	
76,189	19,047	75.37	18.84	3.15	4.19%	72.22	1.22	71.00	0.09	4.46	5.92%	5.97%	4.18%	
79,222	19,805	78.37	19.59	3.41	4.35%	74.96	1.23	73.74	0.09	4.73	6.04%	6.10%	4.35%	
82,254	20,564	81.37	20.34	3.68	4.52%	77.70	1.24	76.46	0.10	5.02	6.16%	6.23%	4.51%	
73,316	18,329	72.53	18.13	2.92	4.03%	69.61	1.21	68.40	0.08	4.21	5.81%	5.85%	4.03%	ERCOT Peak
78,370	19,592	77.53	19.38	3.34	4.30%	74.19	1.22	72.97	0.09	4.65	6.00%	6.06%	4.30%	
83,424	20,856	82.53	20.63	3.78	4.58%	78.75	1.24	77.51	0.10	5.13	6.21%	6.28%	4.58%	
88,478	22,120	87.53	21.88	4.25	4.86%	83.28	1.26	82.01	0.12	5.63	6.43%	6.51%	4.85%	
93,532	23,383	92.53	23.13	4.75	5.14%	87.78	1.28	86.50	0.13	6.16	6.66%	6.75%	5.13%	
98,586	24,647	97.53	24.38	5.28	5.42%	92.25	1.30	90.95	0.14	6.72	6.89%	6.99%	5.41%	
103,640	25,910	102.53	25.63	5.84	5.69%	96.69	1.32	95.37	0.16	7.32	7.13%	7.24%	5.68%	

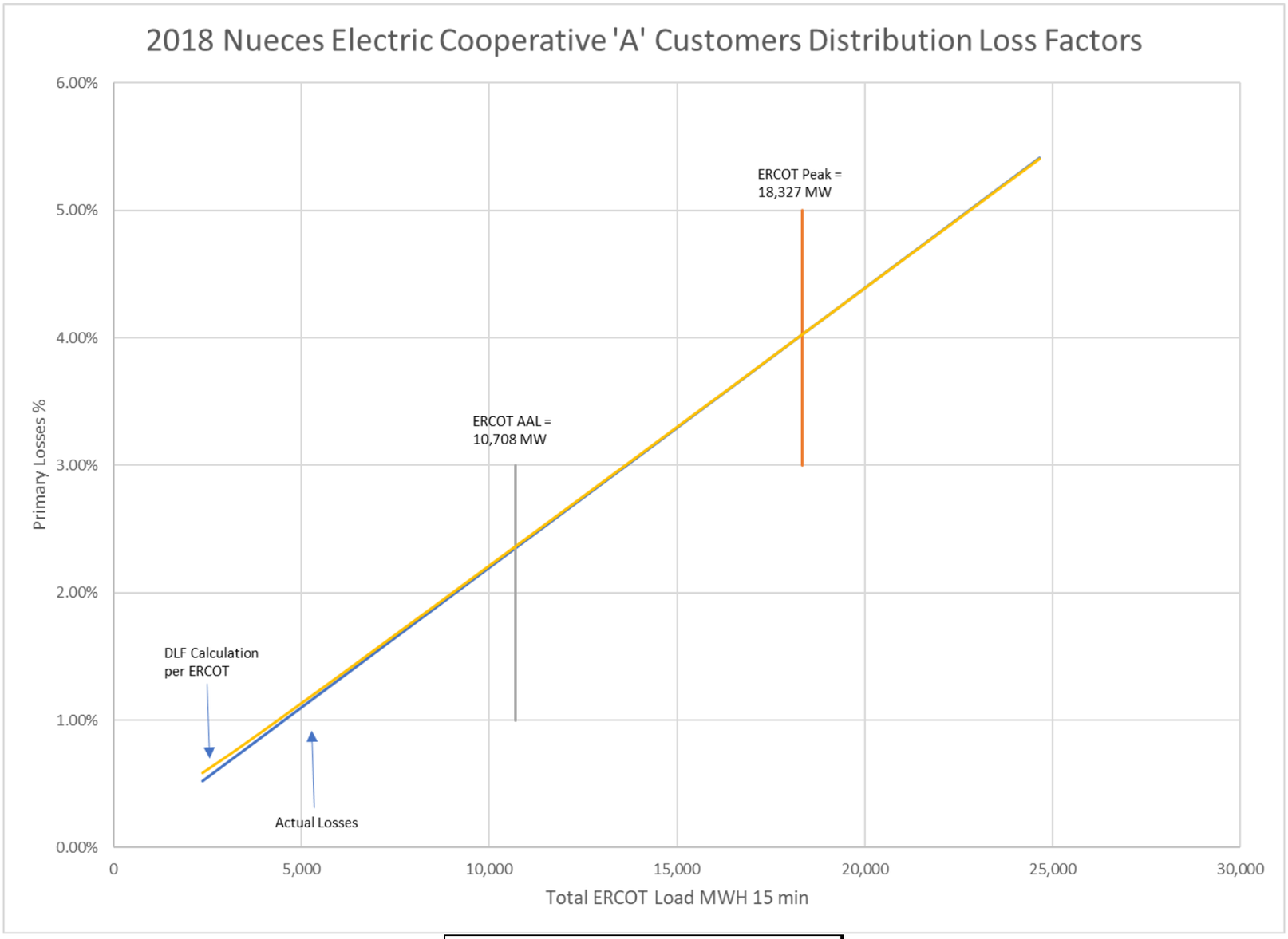
ERCOT Load (1 hr)	ERCOT Interval Load SIEL (15 min)	NEC Load (1 hr)	NEC Interval Load (15 min)									DLF Secondary	DLF Primary	
42,832	10,708	42.37	10.59	1.00	2.35%	41.38	1.13	40.25	0.03	2.16	5.09%	5.07%	2.37%	At ERCOT AAL
73,316	18,329	72.53	18.13	2.92	4.03%	69.61	1.21	68.40	0.08	4.21	5.81%	5.85%	4.03%	At ERCOT Peak

ERCOT		NEC	
1 Hour	15 min	1 Hour	15 min
42,832	10,708	42.37	10.59
73,308	18,327	72.53	18.13

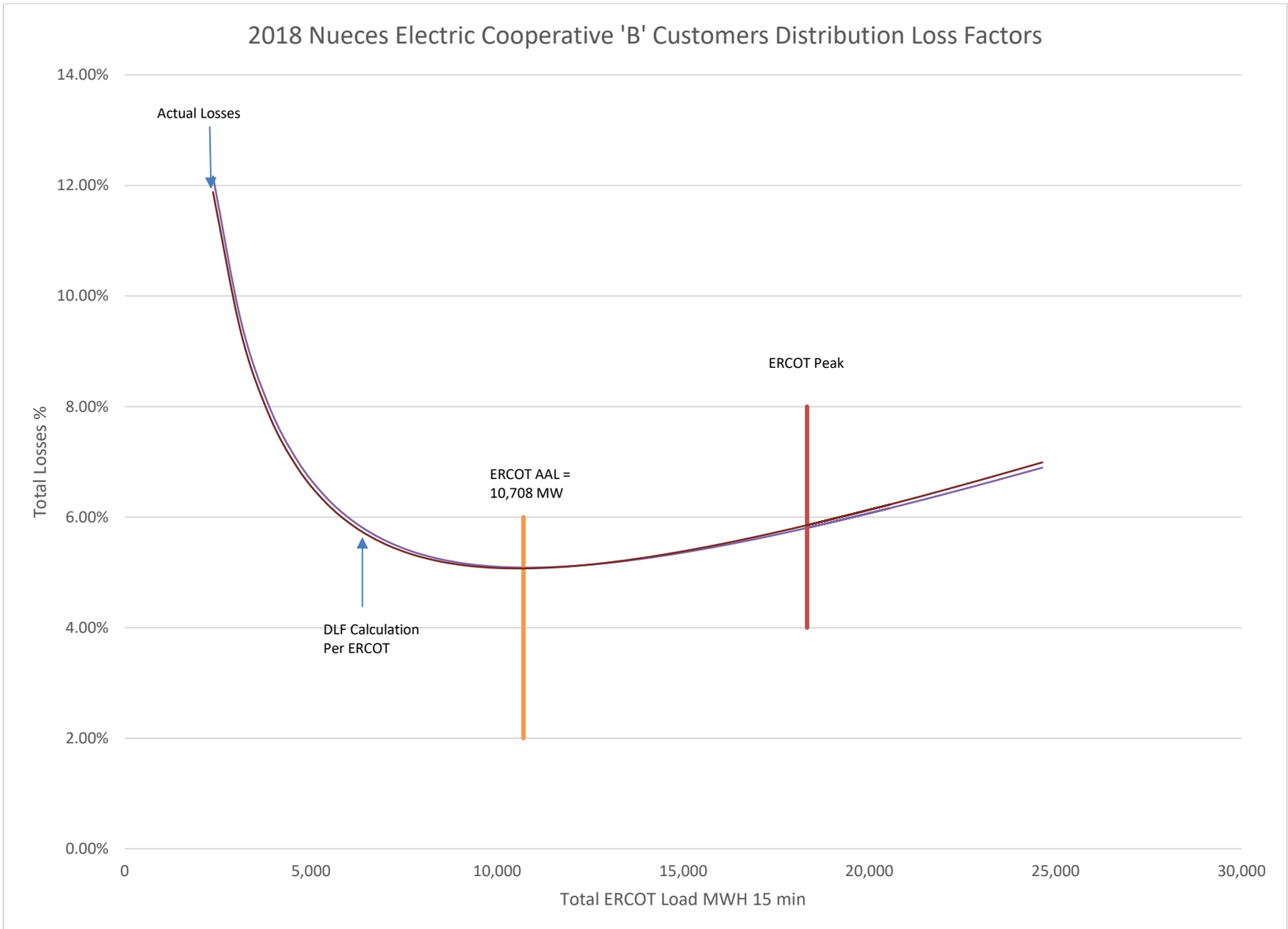
Group B - Secondary Coefficients		
F1	F2	F3
0.0256	0.00012	0.025

Group A - Primary Coefficients		
F1	F2	F3
0.0234	0.0001411	0.00012

	Prim Conductor	Dist Trf	Sec Conductor
A Constant	0.00055526	2.55E-05	1.66529E-05
B Constant	0.00	1.084	0.00



Group A - Primary Coefficients		
F1	F2	F3
0.0234	0.0001411	0.00012



Group B - Secondary Coefficients		
F1	F2	F3
0.0256	0.00012	0.025