



# ComEd Voltage Optimization Impact Evaluation Report

**Energy Efficiency / Demand Response Plan:  
Program Year 2020 (CY2020)  
(1/1/2020-12/31/2020)**

**Prepared for:**

**ComEd  
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## 1. Introduction

This report presents results from the CY2020 impact evaluation of ComEd's Voltage Optimization (VO) Program. It summarizes the total energy and demand impacts for the program broken out by relevant measure and program structure details. Based on guidance from the Illinois Stakeholder Advisory Group (SAG), Guidehouse normalized CY2020 program savings for the coronavirus pandemic.<sup>1</sup> The appendices provide the impact analysis methodology and details of the total resource cost (TRC) inputs. CY2020 covers January 1, 2020 through December 31, 2020.

## 2. Program Description

The VO Program includes ComEd's plan to install hardware and software systems on a significant fraction of its electric power distribution grid to achieve voltage and reactive power optimization (volt-var optimization, or VVO) over the 2018-2025 timeframe. VVO is a smart grid technology that uses distributed sensors, two-way communications infrastructure, remote controls on substation transformer load-tap changers and line capacitor banks, and integrating/optimizing software to flatten voltage profiles and lower average voltage levels on an electric power distribution grid. ComEd is working with an automation-optimization hardware and software vendor<sup>2</sup> to implement the VO Program on selected parts of its distribution grid over the 2018-2025 period.

Unlike energy efficiency programs that achieve savings by providing financial incentives to encourage customers to adopt energy-efficient equipment or behavioral suggestions to encourage them to adopt no-cost energy-saving behaviors, the VO Program involves no direct customer engagement. Instead, savings is achieved by operating the voltage and reactive power controls on VO-enabled feeders and substations in a manner designed to maintain the voltages delivered to affected customers in the lower part of the allowable voltage range.<sup>3</sup>

The program installed and commissioned VO systems on 428 feeders at 43 substations in CY2020;<sup>4</sup> 40 substations were newly activated with VO in CY2020 and three were previously activated but had VO added to additional transformers in CY2020. Table 2-1 shows this information.

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<sup>1</sup> This decision is documented in meeting notes from the June 11 and August 24, 2020 SAG meetings (available at <https://www.ilsag.info/events/list>).

<sup>2</sup> Open Systems International (OSI) of Medina, Minnesota.

<sup>3</sup> The bulk of the energy savings that occurs is thus expected to occur on the customer side of the meter, although additional savings is expected from reduced current flows along the full length of the affected circuits.

<sup>4</sup> CY2020 VO installations occurred throughout the program year. Table 2-1 shows only those substations and feeders on which installation, commissioning, and system testing were completed by December 31, 2020. This table excludes feeders wherein VO was fully enabled on a transformer in CY2020, but the specific feeder did not have any load in CY2020 and feeders where VO was initially enabled but not fully functional in CY2020. It is expected that savings for these types of feeders will be claimed in a future year (either when load is added to the feeder or when VO is fully functional).

**Table 2-1. CY2020 Volumetric Findings Detail**

Participation	Total
Newly VO-Enabled Substations	40
Previously VO-Enabled Substations with new VO Transformers	3
VO-Enabled Feeders	428

Source: ComEd tracking data and evaluation team analysis

### 3. Program Savings Detail

Table 3-1 summarizes the incremental energy and demand savings the VO Program achieved in CY2020. As VO is not a customer-facing program, there is no free ridership and no spillover, and as such the net-to-gross (NTG) ratio is 1 and net and verified gross savings are identical. The program did not claim, and the evaluation did not examine, gas savings.

**Table 3-1. CY2020 Total Annual Incremental Electric Savings**

Savings Category	Energy Savings (kWh)	Summer Peak* Demand Savings (kW)
<b>Electricity</b>		
Ex Ante Gross Savings	216,582,437	46,424
Program Gross Realization Rate	1.00	0.97
Verified Gross Savings	215,996,316	45,134
Program Net-to-Gross Ratio (NTG)	1.00	1.00
Verified Net Savings	215,996,316	45,134
<b>Converted from Gas†</b>		
Ex Ante Gross Savings	NA	NA
Program Gross Realization Rate	NA	NA
Verified Gross Savings	NA	NA
Program Net-to-Gross Ratio (NTG)	NA	NA
Verified Net Savings	NA	NA
<b>Total Electric Plus Gas</b>		
Ex Ante Gross Savings	216,582,437	46,424
Program Gross Realization Rate	1.00	0.97
Verified Gross Savings	215,996,316	45,134
Program Net-to-Gross Ratio (NTG)	1.00	1.00
Verified Net Savings	215,996,316	45,134

NR = not reported (refers a piece of data that was not reported, i.e., non-coincident demand savings).

NA = not applicable (refers a piece of data cannot be produced or does not apply).

\* The coincident summer peak period is defined as 1:00 p.m.-5:00 p.m. Central Prevailing Time on non-holiday weekdays, June through August.

† The evaluation did not estimate gas savings for this program.

Source: ComEd tracking data and evaluation team analysis

### 4. Cumulative Persisting Annual Savings

Table 4-1 show the measure-specific and total verified gross savings for the VO Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2020. Figure

4-1 shows the savings across the useful life of the program. The electric CPAS across all measures installed in 2020 is 215,966,316 kWh (Table 4-1). Guidehouse did not evaluate gas savings for this program and as such electric CPAS is equivalent to total CPAS. The historic rows in each table are the CPAS contribution back to CY2018. The Program Total Electric CPAS row is the sum of the CY2020 contribution and the historic contribution.

**Table 4-1. Cumulative Persisting Annual Savings (CPAS) – Electric**

					Verified Net kWh Savings										
End Use Type	Research Category	CY2020		Lifetime Net											
		EUL Savings (kWh)	Verified Gross Savings (kWh)		NTG*	2018	2019	2020	2021	2022	2023	2024	2025	2026	
All	VO	15.0	215,996,316	1.00	3,239,944,743			215,996,316	215,996,316	215,996,316	215,996,316	215,996,316	215,996,316	215,996,316	215,996,316
			215,996,316		3,239,944,743			215,996,316	215,996,316	215,996,316	215,996,316	215,996,316	215,996,316	215,996,316	215,996,316
						66,014,049	250,055,552	250,055,552	250,055,552	250,055,552	250,055,552	250,055,552	250,055,552	250,055,552	250,055,552
						66,014,049	250,055,552	466,051,868	466,051,868	466,051,868	466,051,868	466,051,868	466,051,868	466,051,868	466,051,868
									-	-	-	-	-	-	-
									-	-	-	-	-	-	-
									-	-	-	-	-	-	-

End Use Type	Research Category	Verified Net kWh Savings													
		2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	
All	VO	215,996,316	215,996,316	215,996,316	215,996,316	215,996,316	215,996,316	215,996,316	215,996,316						
		215,996,316	215,996,316	215,996,316	215,996,316	215,996,316	215,996,316	215,996,316	215,996,316	-	-	-	-	-	
		250,055,552	250,055,552	250,055,552	250,055,552	250,055,552	250,055,552	184,041,503							
		466,051,868	466,051,868	466,051,868	466,051,868	466,051,868	466,051,868	400,037,819	215,996,316	-	-	-	-	-	
		-	-	-	-	-	-	-	-	215,996,316	-	-	-	-	
		-	-	-	-	-	-	66,014,049	184,041,503	-	-	-	-	-	
		-	-	-	-	-	-	66,014,049	184,041,503	215,996,316	-	-	-	-	

Note: The green highlighted cell shows program total first year electric savings. The gray cells are blank, indicating values irrelevant to the CY2020 contribution to CPAS.

\* A deemed value. Source: is found on the Illinois SAG website: [https://www.ilsag.info/ntg\\_2020](https://www.ilsag.info/ntg_2020).

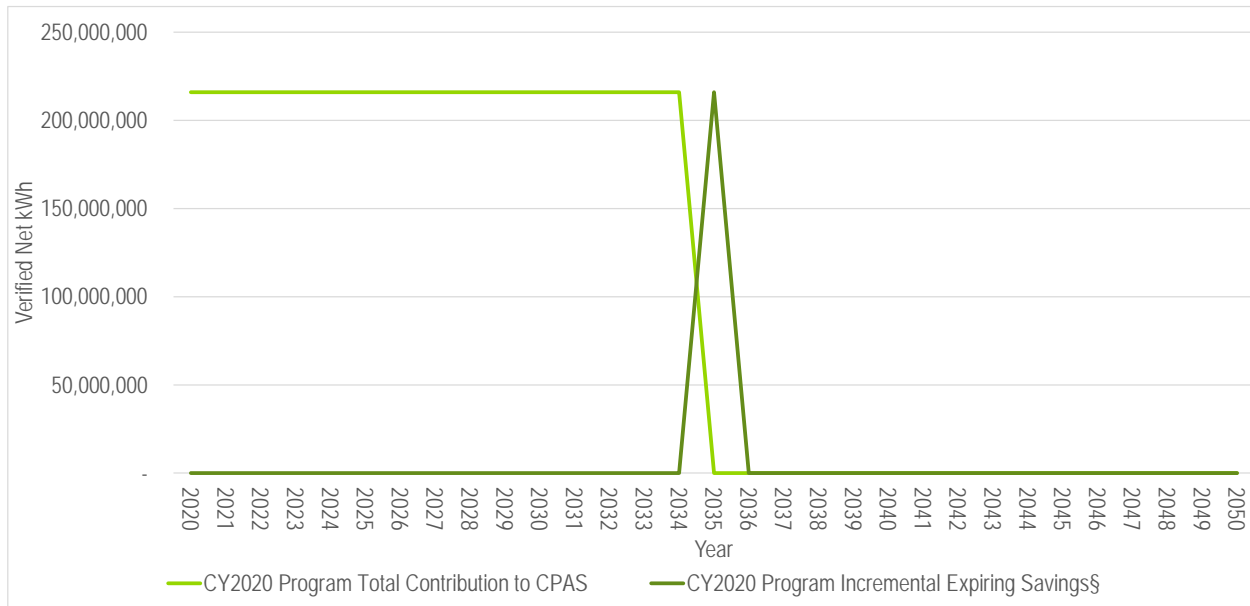
† Lifetime savings are the sum of CPAS savings through the EUL.

‡ Historical savings go back to CY2018.

§ Incremental expiring savings are equal to CPAS Y<sub>n-1</sub> - CPAS Y<sub>n</sub>.

Source: Evaluation team analysis

**Figure 4-1. Cumulative Persisting Annual Savings**



\* Expiring savings are equal to CPAS  $Y_{n-1}$  - CPAS  $Y_n$  + Expiring Savings  $Y_{n-1}$ .

Source: Evaluation team analysis

## 5. Program Savings by Measure

There is only one measure in the VO Program and so measure-level results are the same as the program-level results discussed in the previous section. See Appendix B for detailed savings results.

## 6. Impact Analysis Findings and Recommendations

### 6.1 Impact Parameter Estimates

The VO Program does not have relevant impact parameters.

### 6.2 Other Impact Findings and Recommendations

The evaluation team developed several recommendations based on findings from the CY2020 evaluation.

**Finding 1.** Guidehouse and ComEd identified six feeders that had VO enabled in CY2020 but did not have any load on them in CY2020.<sup>5</sup> These feeders are removed from the CY2020 evaluation.

**Recommendation 1.** After discussion with ComEd and Illinois Commerce Commission (ICC) staff, Guidehouse recommends these feeders be included in a future annual evaluation if they

<sup>5</sup> Note that VO is enabled at the transformer level and many transformers contain multiple feeders.



meet certain criteria.<sup>6</sup> ComEd is working on a memo that will explain the criteria to determine when these feeders are ready to be claimed.

**Finding 2.** Similar to CY2019, ComEd identified a small number of feeders where VO was enabled in CY2020 but was not fully functional throughout the rest of the year.

**Recommendation 2.** As in CY2019, Guidehouse recommends that these feeders be claimed in the year when VO is fully operational.<sup>7</sup>

**Finding 3.** Based on guidance from SAG, Guidehouse normalized CY2020 savings for pandemic-related impacts. Based on the method ComEd, Guidehouse, and ICC staff agreed to (a visual comparison of 2020 data versus 2019 during the same time period), Guidehouse and ComEd agreed that usage data (power or current) was affected by the pandemic during Phases 1 and 2 of the Illinois coronavirus response for approximately one-quarter of feeders while voltage data was not affected. Phase 1 began on March 16 and Phase 2 ended on May 28; together these phases covered the most extreme periods of pandemic restrictions in Illinois.<sup>8</sup>

**Recommendation 3.** Guidehouse recommends that usage data be removed during Phases 1 and 2 of the Illinois coronavirus response for the affected feeders. This was implemented in this report and Appendix A describes this in further detail.

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<sup>6</sup> Accordingly, these feeders were excluded from the CY2020 feeder count in Table 2-1.

<sup>7</sup> Accordingly, these feeders were excluded from the CY2020 feeder count in Table 2-1.

<sup>8</sup> More information on restrictions by phase can be found at <https://coronavirus.illinois.gov/s/restore-illinois-introduction>.

## Appendix A. Impact Analysis Methodology

The evaluation team used the approach specified in the Illinois Statewide Technical Reference Manual (TRM v9.0) to estimate the VO Program's energy and demand savings.<sup>9</sup>

### A.1 Energy Savings Methodology

The TRM relies on a conservation voltage reduction factor (CVRf), which is deemed at 0.8, and utilizes Equation A-1 to estimate energy savings.

#### Equation A-1. Energy Savings Calculation

$$\text{Energy Savings} = \text{Energy Baseline} * \text{CVRf} * \text{Voltage Reduction Percentage}$$

In accordance with the TRM, in cases where power (MW) data was not available, Guidehouse converted the corresponding current (amps) value to MW using Equation A-2 through Equation A-4. This conversion was applied to at least some of the data used for reconstruction (data from January 1, 2019 to January 31, 2021) for 181 feeders.

#### Equation A-2. Amps-to-MW Conversion (Three-Phase with Line-to-Line Voltage)

$$P_t = \sqrt{3} * V_t * I_t * p_f$$

#### Equation A-3. Amps-to-MW Conversion (Three-Phase with Line-to-Neutral Voltage)

$$P_t = 3 * V_t * I_t * p_f$$

#### Equation A-4. Amps-to-MW Conversion (Single Phase)

$$P_t = V_t * I_t * p_f$$

Where:

$P_t$	Calculated MW data at time $t$
$V_t$	Average measured voltage at time $t$
$I_t$	Average measured amps at time $t$
$p_f$	Power factor assumed to be 0.9 <sup>10</sup>

In accordance with the TRM that the evaluator will address any data quality issues, Guidehouse cleaned the megawatt (MW) and voltage data by removing anomalous values of the following types:

1. Negative values<sup>11</sup>

<sup>9</sup> See Measure 6.2.1, Volume 4, Version 9.0 of the TRM (TRM v9.0). Note that we are referencing TRM v9.0 even though TRM v8.0 is applicable in CY2020 because this measure was new for TRM v9.0 and so not included in TRM v8.0.

<sup>10</sup> Guidehouse used ComEd's assumed power factor of 0.9. We reviewed this parameter during our CY2019 evaluation and found this assumption to be reasonable.

<sup>11</sup> Only negative voltage values are removed in this step. Note negative usage values are removed as outliers in step 7 for feeders without distributed energy resources (DER).

2. Non-numeric values
3. Zero values
4. Missing values
5. Repetitive values<sup>12</sup>
6. Interpolated values<sup>13</sup>
7. Outlier values
  - a. MW
    - i. Defined as values above 110% or below 10% of the feeder peak load for feeders without distributed energy resources (DER).
    - ii. Defined as values above 110% of the feeder peak load or below the expected reverse power for feeders with DER.<sup>14</sup>
  - b. Voltage
    - i. Defined as values above 1.10 per unit (p.u.) and below 0.90 p.u. of the nominal line-to-line voltage level for regular transformers and the line-to-neutral voltage for DC-in-a-box (DCIAB) transformers.

Guidehouse also executed the following data cleaning steps specific to CY2020 data anomalies:

- Power (MW) or current (amps) data were excluded from March 16 through May 28<sup>15</sup> for 119 feeders that appeared to be affected by pandemic-related impacts based on the method ComEd, Guidehouse, and ICC staff agreed to (a visual comparison of 2020 load data versus 2019 during the same time period). This was done in accordance with the SAG decision that CY2020 savings should be normalized for the effects of the pandemic.
- For 13 transformers across five substations (covering 48 feeders) commissioning the transformer for VO revealed that the voltage was lower than the standardized operating level within ComEd territory. As a result, ComEd made a discrete increase to the voltage before enabling VO to bring it up to an acceptable level. For these transformers, voltage data from January 1, 2019 until said shift were excluded from the analysis.
- For 28 transformers across eight substations (covering 149 feeders), enabling VO revealed that new equipment was needed for the full potential reduction in voltage from VO to be realized. Installations were completed between September and November of 2020 and resulted in a revised VO go live date to acknowledge that only the savings after VO was operating at its full potential reflect the expectation of how VO will operate for the rest of the 15 year measure life. For the analysis load and voltage data for VO on

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<sup>12</sup> Repetitive values are cases where three values in a row match up to six decimal places.

<sup>13</sup> Interpolated values are detected when the difference between values is the same (up to three decimal places) for at least two values in a row.

<sup>14</sup> The expected reverse power flow ( $P_{rev}$ ) is calculated based on the total installed DER capacity on the feeder ( $P_{DER}$ ) and the expected feeder demand during DER peak time ( $P_{Demand} = 50\%$  of feeder peak load):

$$P_{rev} = P_{Demand} - P_{DER}$$

<sup>15</sup> These dates align with the start of Phase 1 of the coronavirus response in Illinois and the end of Phase 2, covering the most extreme restrictions. More information on restrictions by phase can be found at <https://coronavirus.illinois.gov/s/restore-illinois-introduction>.

periods before the revised VO go live date were excluded and the VO status was assumed to be off.

- Four feeders being claimed in CY2020 were initially enabled in CY2019 but were not fully functional and thus could not be claimed in CY2019. For three of these feeders (C211, C858, and G091), any VO on periods in 2019 were assumed to be off and the associated load and voltage data were excluded. For the fourth feeder (W513), all VO on periods through June 17, 2020 were assumed to be off without the removal of any load or voltage data; separately for this feeder, certain instances of voltage data were excluded for being more volatile than usual (similar to the next bullet).
- One feeder (H651) had periods of more volatile than usual voltage due to equipment issues. Voltage for these periods was excluded from the analysis.

In accordance with the TRM v9.0, Guidehouse created a lookup table to reconstruct load (MW<sup>16</sup>) and voltage data that was missing or eliminated by the data cleaning process based on the priority sequence shown in Table A-1. Guidehouse used data from January 1, 2019 through January 31, 2021 to reconstruct data for CY2020. Compared to CY2019, bins 14 to 26 were added to reflect rare instances where a specific feeder has no available data for one VO status or the other.<sup>17</sup>

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<sup>16</sup> Either recorded MW or MW converted from amps.

<sup>17</sup> This is only expected to occur very rarely if a feeder had VO go live toward the very end of the year paired with a stretch of missing data or data removed during cleaning. This occurred for one feeder's, G6092, load (MW) data in CY2020.

**Table A-1. Data Reconstruction Priority Sequence**

Priority	Components and Commonalities of Table
1	Season*, Temperature†, Day Type‡, Hour§, VO Status
2	Temperature, Day Type, Hour, VO Status
3-5	Temperature +/-5  , Day Type, Hour, VO Status
6	Season, Day Type, Hour, VO Status
7	Temperature, Day Type, VO Status
8	Season, Day Type, VO Status
9	Temperature, VO Status
10	Season, VO Status
11	Day Type, Hour, VO Status
12	Day Type, VO Status
13	VO Status
14	Season*, Temperature†, Day Type, Hour
15	Temperature, Day Type, Hour
16-18	Temperature +/-5, Day Type, Hour
19	Season, Day Type, Hour
20	Temperature, Day Type
21	Season, Day Type
22	Temperature
23	Season
24	Day Type, Hour
25	Day Type
26	- #

\* Seasons are: Spring (March to May), Summer (June to August), Fall (September to November), and Winter (December to February)

† Temperature was binned to the ceiling of the nearest 5°F interval.

Guidehouse sourced temperature data from the National Oceanic and Atmospheric Administration (NOAA) Quality Controlled Local Climatological Data (QCLCD) weather station geographically closest to each feeder.

Guidehouse filled in missing data via linear interpolation (for gaps of four or fewer hours) or from the next closest weather station (for gaps longer than four hours).

‡ Day types are weekdays (Monday to Friday) and weekends (Saturday and Sunday).

§ Hour refers to the same hour of the day.

|| Temperature +/-5 refers to temperatures one 5°F bin above or below the temperature of the observation being reconstructed. This occurred in three stages where we first looked across the bin above and below and then in just one or the other if there were no data points in one of them.

# All data points will be averaged.

Source: ComEd and Guidehouse

Load and voltage data were cleaned separately and Table A-2 shows how much of the reconstructed data for each unit came from each priority bin in Table A-1.

**Table A-2. Data Reconstruction**

Priority Bin	Percentage Voltage Data (kV)	Percentage Load Data (MW)
Actual Measured	83.67%	81.89%
1	12.75%	17.45%
2	3.15%	0.49%
3-5	0.29%	0.14%
6	0.00%	0.00%
7	0.04%	0.01%
8	<0.01%	0.00%
9	0.01%	0.00%
10	0.00%	0.00%
11	0.09%	0.00%
12	0.00%	0.00%
13	0.00%	0.00%
14	0.00%	0.02%

Note priority bins below 14 were never utilized in the CY2020 evaluation.

Source: ComEd tracking data and evaluation team analysis

To estimate the voltage reduction percentage, Guidehouse constructed the counterfactual voltage profile based on the same priority sequence as Table A-1 shows.<sup>18</sup>

In estimating energy savings, Guidehouse accounted for line losses of 3.67%<sup>19</sup> and a de-rating factor of 0.3003% to account for times when VO is expected to be off for reasons that are within ComEd's control for each year of the 15 year measure life. The calculation of the de-rating factor is discussed in Section Appendix D.

## A.2 Peak Demand Savings Methodology

The estimation of peak demand savings was similar to energy savings and follows Equation A-5.

### Equation A-5. Peak Savings Calculation

$$\text{Peak Savings} = \text{Peak Baseline} * CVRf_{peak} * \text{Voltage Reduction Percentage}_{peak}$$

Where:

*Peak Baseline*

Baseline kW usage on the feeder during the peak period, defined as 1:00 p.m.-5:00 p.m. CDT on non-holiday weekdays from June 1 to August 31. This

<sup>18</sup> For constructing the counterfactual voltage profile only bins 1-13 are used.

<sup>19</sup> Distribution system energy losses are assumed to be 3.67%, based on ComEd's filed 2019 ComEd Distribution System Loss Study.

ComEd. 2020. *2019 ComEd Distribution System Loss Study*. Docket No. 20. ComEd Ex. 6.01. Available at: <https://www.icc.illinois.gov/downloads/public/edocket/520735.PDF>

$CVR_{f_{peak}}$ *Voltage Reduction Percentage<sub>peak</sub>*

was be calculated in the same manner as baseline for energy savings but with the intent of estimating the baseline just for the peak period as opposed to for the entire year.

1.02

Percentage voltage reduction on the feeder caused by VO during the peak period, defined as 1:00 p.m.-5:00 p.m. CDT on non-holiday weekdays from June 1 to August 31. This was be calculated in the same manner as for energy savings but with the intent of estimating the peak period as opposed to the entire year.

## Appendix B. Impact Analysis Detail

Table B-1 presents the verified CY2020 VO Program energy impacts and realization rate by feeder, Table B-2 presents the same for demand, and Table B-3 rolls results up to the substation.

**Table B-1. CY2020 Verified VO Energy Savings and Voltage Reductions by Feeder**

Substation	Feeder	VO Go Live	CVRf	Energy Baseline (MWh)	Average Voltage Reduction* (%)	Ex Ante Energy Savings (MWh)	Verified Energy Savings (MWh)	Energy Realization Rate
DCB51	B511	8/28/2020	0.8	31,265.049	4.70%	1,141.227	1,129.959	0.99
DCB51	B518	9/29/2020	0.8	15,679.945	4.27%	506.664	514.130	1.01
DCC21	C211	6/3/2020	0.8	8,084.071	4.09%	247.123	254.090	1.03
DCC33	C339	8/28/2020	0.8	16,252.939	3.93%	492.249	491.291	1.00
DCC85	C858	9/5/2020	0.8	15,829.838	4.76%	573.259	578.480	1.01
DCD47	D4701	7/27/2020	0.8	15,612.336	4.29%	516.000	513.975	1.00
DCE82	E821	7/27/2020	0.8	25,019.947	4.62%	887.352	887.341	1.00
DCF17	F176	11/21/2020	0.8	18,682.924	5.13%	731.602	736.500	1.01
DCG909	G091	6/9/2020	0.8	6,399.011	4.43%	221.163	217.740	0.98
DCH23	H235	7/27/2020	0.8	14,230.795	3.77%	412.525	412.062	1.00
DCH23	H236	7/27/2020	0.8	18,470.650	4.46%	628.473	633.350	1.01
DCH65	H651	11/16/2020	0.8	17,078.709	5.25%	685.349	689.066	1.01
DCH70	H706	4/16/2020	0.8	6,301.522	4.87%	236.703	235.680	1.00
DCH70	H705	1/13/2020	0.8	12,169.675	5.06%	473.271	472.763	1.00
DCJ92	J925	2/14/2020	0.8	25,418.713	4.37%	853.872	852.926	1.00
DCJ92	J926	2/14/2020	0.8	15,007.945	4.33%	502.679	499.730	0.99
DCS63	S635	10/31/2020	0.8	13,170.263	4.39%	446.101	443.802	0.99
DCW211	W111	7/27/2020	0.8	20,790.547	4.42%	702.031	705.715	1.01
DCW211	W112	7/27/2020	0.8	19,949.250	4.43%	673.891	679.594	1.01
DCW334	W341	9/29/2020	0.8	21,476.238	5.10%	836.267	841.503	1.01
DCW51	W513	6/17/2020	0.8	26,440.788	3.76%	739.055	763.064	1.03
TDC215	C1510	6/25/2020	0.8	21,464.150	3.54%	583.680	583.495	1.00
TDC215	C1511	6/25/2020	0.8	15,878.304	3.52%	429.870	429.676	1.00
TDC215	C1512	6/25/2020	0.8	20,060.691	3.61%	557.691	555.752	1.00
TDC215	C1513	6/25/2020	0.8	6,717.179	3.58%	184.668	184.543	1.00
TDC215	C1517	6/25/2020	0.8	17,689.549	3.66%	497.944	497.800	1.00
TDC215	C1514	6/25/2020	0.8	14,976.689	3.55%	409.087	408.801	1.00
TDC215	C1515	6/25/2020	0.8	12,008.258	3.53%	325.195	325.401	1.00
TDC215	C1516	6/25/2020	0.8	17,823.668	3.55%	485.977	486.060	1.00
TDC215	C1518	6/25/2020	0.8	7,880.431	3.65%	221.106	220.890	1.00
TDC215	C1520	6/25/2020	0.8	19,337.617	3.57%	531.885	529.953	1.00



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TDC220	E2005	9/29/2020	0.8	15,164.195	3.84%	445.285	447.382	1.00
TDC220	E2006	9/29/2020	0.8	17,373.894	3.82%	505.973	509.426	1.01
TDC220	E2007	9/29/2020	0.8	18,988.389	3.84%	556.673	559.992	1.01
TDC220	E2008	9/29/2020	0.8	25,378.949	3.85%	748.380	751.290	1.00
TDC220	E2009	9/29/2020	0.8	15,136.347	3.84%	444.526	446.542	1.00
TDC220	E2010	9/29/2020	0.8	19,692.718	3.85%	581.365	581.751	1.00
TDC220	E2016	9/29/2020	0.8	17,903.907	3.89%	530.751	534.617	1.01
TDC220	E2018	9/29/2020	0.8	10,605.858	3.94%	321.958	320.662	1.00
TDC220	E2019	9/29/2020	0.8	9,763.421	3.99%	299.648	299.640	1.00
TDC220	E2020	9/29/2020	0.8	13,450.971	3.98%	409.183	411.632	1.01
TDC220	E2021	9/29/2020	0.8	14,153.704	3.93%	424.837	427.303	1.01
TDC220	E2012	9/29/2020	0.8	13,912.235	3.80%	402.537	406.653	1.01
TDC220	E2013	9/29/2020	0.8	25,938.870	3.84%	759.886	764.543	1.01
TDC220	E2014	9/29/2020	0.8	11,527.841	3.81%	334.405	337.792	1.01
TDC220	E2015	9/29/2020	0.8	19,359.886	3.81%	562.455	567.250	1.01
TDC221	E2101	10/31/2020	0.8	15,413.392	4.68%	553.225	554.637	1.00
TDC221	E2102	10/31/2020	0.8	17,648.013	4.68%	632.296	634.075	1.00
TDC221	E2103	10/31/2020	0.8	9,736.400	4.69%	349.512	350.633	1.00
TDC221	E2104	10/31/2020	0.8	22,703.103	4.69%	813.852	818.233	1.01
TDC221	E2105	10/31/2020	0.8	14,588.125	4.59%	510.227	514.549	1.01
TDC221	E2106	10/31/2020	0.8	17,480.625	4.62%	616.497	620.189	1.01
TDC221	E2107	10/31/2020	0.8	12,425.166	4.56%	432.473	435.624	1.01
TDC221	E2108	10/31/2020	0.8	23,070.458	4.62%	810.365	819.441	1.01
TDC221	E2109	10/31/2020	0.8	16,269.389	4.57%	567.574	571.694	1.01
TDC221	E2110	10/31/2020	0.8	5,102.556	4.60%	179.040	180.133	1.01
TDC222	C2215	11/8/2020	0.8	16,357.562	4.94%	618.811	620.468	1.00
TDC222	C2217	11/8/2020	0.8	20,488.375	4.91%	768.213	772.571	1.01
TDC222	C2218	11/8/2020	0.8	27,328.816	4.90%	1,020.522	1,028.248	1.01
TDC222	C2211	11/8/2020	0.8	19,262.650	4.10%	590.153	606.417	1.03
TDC222	C2212	11/8/2020	0.8	12,577.261	4.11%	391.079	397.552	1.02
TDC222	C2214	11/8/2020	0.8	22,061.288	4.08%	673.113	691.480	1.03
TDC222	C2220	11/8/2020	0.8	32,070.422	4.11%	989.366	1,012.478	1.02
TDC240	E4001	9/29/2020	0.8	15,635.251	4.17%	502.160	501.159	1.00
TDC240	E4002	9/29/2020	0.8	15,408.415	4.14%	490.577	490.615	1.00
TDC240	E4003	9/29/2020	0.8	16,754.095	4.15%	534.718	533.624	1.00
TDC240	E4004	9/29/2020	0.8	13,112.655	4.17%	421.591	419.948	1.00
TDC240	E4005	9/29/2020	0.8	14,799.223	4.24%	474.289	482.326	1.02

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TDC240	E4006	9/29/2020	0.8	15,322.207	4.26%	492.239	500.941	1.02
TDC240	E4007	9/29/2020	0.8	16,301.277	4.24%	521.483	531.209	1.02
TDC240	E4008	9/29/2020	0.8	30,520.159	4.23%	977.986	991.895	1.01
TDC260	E6020	8/28/2020	0.8	16,033.081	3.85%	481.300	473.783	0.98
TDC260	E6021	8/28/2020	0.8	15,696.071	3.84%	470.755	462.689	0.98
TDC260	E6022	8/28/2020	0.8	24,865.757	3.85%	749.149	735.936	0.98
TDC260	E6023X	8/28/2020	0.8	21,301.212	3.85%	642.188	630.784	0.98
TDC260	E6023Y	8/28/2020	0.8	4,754.531	3.79%	141.862	138.346	0.98
TDC260	E6024	8/28/2020	0.8	7,759.957	3.84%	233.802	229.144	0.98
TDC260	E6025	8/28/2020	0.8	24,623.952	3.87%	750.618	731.620	0.97
TDC260	E6026	8/28/2020	0.8	14,652.258	3.85%	445.918	433.082	0.97
TDC260	E6027	8/28/2020	0.8	25,233.244	3.86%	768.395	749.067	0.97
TDC260	E6028Y	8/28/2020	0.8	24,207.991	3.84%	736.126	713.922	0.97
TDC260	E6029	8/28/2020	0.8	20,260.550	3.85%	616.718	599.321	0.97
TDC268	E680X	11/18/2020	0.8	11,734.368	4.02%	367.799	362.639	0.99
TDC268	E680Y	11/18/2020	0.8	11,324.678	4.03%	352.720	350.185	0.99
TDC268	E6811	11/18/2020	0.8	6,852.447	4.03%	214.863	212.346	0.99
TDC268	E6815	11/18/2020	0.8	11,177.105	4.02%	351.280	345.235	0.98
TDC268	E6819	11/18/2020	0.8	23,141.268	4.04%	725.023	718.194	0.99
TDC268	E6821	11/18/2020	0.8	16,866.531	4.03%	526.727	522.498	0.99
TDC268	E684	11/18/2020	0.8	16,652.942	4.02%	518.871	513.675	0.99
TDC268	E688	11/18/2020	0.8	18,477.899	4.03%	579.636	571.784	0.99
TDC268	E689X	11/18/2020	0.8	14,683.953	4.03%	461.487	454.542	0.98
TDC268	E689Y	11/18/2020	0.8	14,096.655	4.03%	442.835	436.039	0.98
TDC268	E6810	11/18/2020	0.8	18,037.935	3.60%	497.224	498.387	1.00
TDC268	E681X	11/18/2020	0.8	10,124.948	3.59%	280.123	279.438	1.00
TDC268	E681Y	11/18/2020	0.8	15,993.839	3.61%	442.125	442.990	1.00
TDC268	E682	11/18/2020	0.8	13,220.510	3.59%	365.225	365.062	1.00
TDC268	E685	11/18/2020	0.8	24,272.822	3.60%	670.107	671.718	1.00
TDC268	E6812X	11/18/2020	0.8	10,956.493	4.04%	345.191	339.794	0.98
TDC268	E6812Y	11/18/2020	0.8	3,546.748	4.04%	111.484	110.142	0.99
TDC268	E6820	11/18/2020	0.8	18,183.890	4.03%	570.781	563.197	0.99
TDC268	E6823	11/18/2020	0.8	20,813.441	4.03%	651.677	644.213	0.99
TDC268	E686	11/18/2020	0.8	12,645.847	4.03%	398.532	391.389	0.98
TDC268	E6813	11/18/2020	0.8	21,157.304	3.71%	598.499	603.338	1.01
TDC268	E6814	11/18/2020	0.8	21,129.136	3.71%	599.824	601.501	1.00
TDC268	E6816X	11/18/2020	0.8	17,107.905	3.71%	484.037	487.344	1.01

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TDC268	E6816Y	11/18/2020	0.8	21,504.206	3.70%	609.227	612.046	1.00
TDC268	E6817	11/18/2020	0.8	19,213.055	3.71%	545.724	547.756	1.00
TDC268	E6818	11/18/2020	0.8	16,152.093	3.72%	457.885	461.477	1.01
TDC268	E683X	11/18/2020	0.8	16,240.291	3.70%	460.728	461.315	1.00
TDC268	E687	11/18/2020	0.8	14,686.086	3.70%	415.675	417.978	1.01
TDC317	H1701	4/23/2020	0.8	24201.369	3.55%	644.464	660.441	1.02
TDC317	H1702	4/23/2020	0.8	23,758.764	3.55%	634.092	648.274	1.02
TDC317	H1703	4/23/2020	0.8	5,920.751	3.57%	158.823	162.377	1.02
TDC416	J1670	11/21/2020	0.8	19,443.965	4.47%	645.722	667.959	1.03
TDC416	J1671	11/21/2020	0.8	17,067.400	4.47%	568.947	586.717	1.03
TDC416	J1672	11/21/2020	0.8	20,193.864	4.47%	672.191	693.453	1.03
TDC416	J1674	11/21/2020	0.8	18,127.000	4.49%	604.818	625.578	1.03
TDC416	J1676	11/21/2020	0.8	14,344.062	4.48%	478.438	494.097	1.03
TDC416	J1677	11/21/2020	0.8	18,869.758	4.49%	630.480	650.182	1.03
TDC416	J1678	11/21/2020	0.8	13,405.173	4.45%	443.556	458.246	1.03
TDC416	J1680	11/21/2020	0.8	14,777.367	4.52%	498.395	513.353	1.03
TDC416	J1681	11/21/2020	0.8	13,865.803	4.50%	465.972	479.627	1.03
TDC416	J1684	11/21/2020	0.8	10,789.669	4.51%	363.650	373.682	1.03
TDC419	G1971	10/23/2020	0.8	23,723.175	2.94%	540.519	535.791	0.99
TDC419	G1972	10/23/2020	0.8	11,428.120	2.94%	259.397	257.730	0.99
TDC419	G1973	10/23/2020	0.8	13,536.710	2.94%	308.272	305.574	0.99
TDC419	G1974	10/23/2020	0.8	14,217.214	2.85%	314.947	310.759	0.99
TDC419	G1975	10/23/2020	0.8	14,573.920	2.94%	333.474	329.571	0.99
TDC419	G1977X	10/23/2020	0.8	17,067.977	2.91%	386.133	381.807	0.99
TDC419	G1977Y	10/23/2020	0.8	16,544.133	2.94%	378.037	373.582	0.99
TDC419	G1978X	10/23/2020	0.8	18,905.114	2.95%	433.395	427.766	0.99
TDC419	G1978Y	10/23/2020	0.8	17,262.466	2.96%	395.775	391.949	0.99
TDC419	G1985	10/23/2020	0.8	13,146.999	3.49%	362.833	352.416	0.97
TDC419	G1986X	10/23/2020	0.8	13,973.962	3.42%	377.979	367.552	0.97
TDC419	G1986Y	10/23/2020	0.8	18,562.616	3.41%	498.251	486.224	0.98
TDC419	G1987	10/23/2020	0.8	17,736.127	3.45%	482.145	469.933	0.97
TDC419	G1988	10/23/2020	0.8	21,641.933	3.44%	586.551	571.628	0.97
TDC419	G1989	10/23/2020	0.8	14,048.712	3.47%	384.884	374.734	0.97
TDC419	G1990	10/23/2020	0.8	16,907.432	3.45%	461.400	447.947	0.97
TDC419	G1991	10/23/2020	0.8	24,647.937	3.44%	669.742	651.119	0.97
TDC419	G1992	10/23/2020	0.8	13,791.065	3.39%	366.598	358.937	0.98
TDC419	G1981X	10/23/2020	0.8	5,972.023	2.96%	138.539	135.620	0.98

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TDC419	G1982	10/23/2020	0.8	27,739.224	2.95%	634.908	628.454	0.99
TDC419	G1983	10/23/2020	0.8	12,317.142	2.91%	277.799	275.520	0.99
TDC419	G1984	10/23/2020	0.8	14,353.641	2.95%	325.387	325.161	1.00
TDC419	G1993	10/23/2020	0.8	20,280.891	3.42%	551.660	532.526	0.97
TDC419	G1994	10/23/2020	0.8	6,234.446	3.37%	167.044	161.533	0.97
TDC419	G1995	10/23/2020	0.8	18,178.834	3.35%	483.278	467.690	0.97
TDC419	G1996	10/23/2020	0.8	12,770.148	3.36%	341.042	329.526	0.97
TDC419	G1997	10/23/2020	0.8	15,303.615	3.43%	418.326	403.248	0.96
TDC419	G1998	10/23/2020	0.8	19,794.262	3.42%	538.953	520.687	0.97
TDC451	J5111	9/13/2020	0.8	15,519.643	3.57%	426.422	425.458	1.00
TDC451	J5112	9/13/2020	0.8	17,976.053	3.61%	503.149	498.445	0.99
TDC451	J5114	9/13/2020	0.8	24,505.851	3.61%	682.765	678.748	0.99
TDC451	J5141	9/13/2020	0.8	16,695.511	3.57%	452.651	457.750	1.01
TDC451	J5184	9/13/2020	0.8	23,158.117	3.56%	625.726	632.589	1.01
TDC451	J5161	7/3/2020	0.8	17,997.980	2.33%	321.593	322.263	1.00
TDC451	J5181	7/3/2020	0.8	27,715.670	2.26%	483.413	481.909	1.00
TDC451	J5121	7/3/2020	0.8	16,242.561	2.29%	286.846	285.321	0.99
TDC451	J5152	7/3/2020	0.8	14,922.079	2.38%	272.353	273.030	1.00
TDC451	J5153	7/3/2020	0.8	20,911.740	2.27%	367.232	365.187	0.99
TDC451	J5154	7/3/2020	0.8	22,344.295	2.23%	383.953	382.771	1.00
TDC451	J5122	7/3/2020	0.8	19,281.845	3.28%	481.031	485.996	1.01
TDC451	J5123	7/3/2020	0.8	17,759.964	3.29%	445.054	449.501	1.01
TDC451	J5162	7/3/2020	0.8	14,382.074	3.28%	360.461	362.836	1.01
TDC451	J5131	7/3/2020	0.8	25,153.755	3.37%	653.329	650.282	1.00
TDC451	J5133	7/3/2020	0.8	20,506.297	3.34%	528.859	526.670	1.00
TDC451	J5134	7/3/2020	0.8	20,526.928	3.36%	531.760	529.785	1.00
TDC451	J5113	8/14/2020	0.8	21,543.276	3.52%	586.398	583.015	0.99
TDC451	J5124	8/14/2020	0.8	17,069.438	3.53%	467.364	463.395	0.99
TDC451	J5163	8/14/2020	0.8	16,933.793	3.54%	463.667	460.088	0.99
TDC451	J5164	8/14/2020	0.8	22,666.656	3.53%	618.831	614.300	0.99
TDC451	J5151	8/14/2020	0.8	23,986.728	3.54%	655.288	653.138	1.00
TDC451	J5171	8/14/2020	0.8	16,642.185	3.56%	455.167	455.252	1.00
TDC555	W553	11/16/2020	0.8	24,291.979	4.47%	824.128	835.117	1.01
TDC555	W554	11/16/2020	0.8	9,629.376	4.50%	329.997	333.171	1.01
TDC555	W556	11/16/2020	0.8	15,744.958	4.50%	536.783	543.984	1.01
TDC555	W557	11/16/2020	0.8	19,585.013	4.49%	667.764	676.087	1.01
TDC555	W558	11/16/2020	0.8	17,939.587	4.49%	611.186	619.409	1.01

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TDC555	W550	11/16/2020	0.8	22,725.821	3.72%	624.948	650.299	1.04
TDC555	W551	11/16/2020	0.8	16,841.621	3.73%	463.552	481.964	1.04
TDC555	W5512	11/16/2020	0.8	18,573.014	3.72%	509.526	530.983	1.04
TDC555	W552	11/16/2020	0.8	15,766.065	3.76%	438.773	455.181	1.04
TDC555	W555	11/16/2020	0.8	8,496.800	3.73%	234.427	243.709	1.04
TDC555	W559	11/16/2020	0.8	17,443.443	3.72%	480.522	499.146	1.04
TDC557	W570	11/21/2020	0.8	13,112.377	4.78%	485.968	481.860	0.99
TDC557	W571	11/21/2020	0.8	22,165.473	4.69%	806.139	797.956	0.99
TDC557	W573	11/21/2020	0.8	20,268.971	4.72%	741.148	734.692	0.99
TDC557	W578	11/21/2020	0.8	19,005.018	4.76%	701.349	695.323	0.99
TDC557	W579	11/21/2020	0.8	22,261.986	4.70%	813.112	804.403	0.99
TDC557	W5710	11/21/2020	0.8	26,924.708	3.05%	620.636	631.708	1.02
TDC557	W574	11/21/2020	0.8	16,682.584	3.07%	387.295	393.067	1.01
TDC557	W575	11/21/2020	0.8	9,849.920	3.10%	230.345	234.653	1.02
TDC557	W576	11/21/2020	0.8	11,894.213	3.11%	281.544	283.807	1.01
TDC557	W577X	11/21/2020	0.8	9,456.168	3.06%	220.760	222.350	1.01
TDC557	W577Y	11/21/2020	0.8	12,789.813	3.13%	301.559	307.692	1.02
TDC648	X4851	11/21/2020	0.8	14,890.820	3.94%	445.938	450.778	1.01
TDC648	X4852	11/21/2020	0.8	16,918.496	3.99%	512.773	518.400	1.01
TDC648	X4853	11/21/2020	0.8	14,714.958	4.04%	452.478	456.569	1.01
TDC648	X4855	11/21/2020	0.8	18,041.860	4.08%	561.859	565.017	1.01
TDC648	X4856	11/21/2020	0.8	21,918.712	4.03%	673.622	678.348	1.01
TDC648	X4857	11/21/2020	0.8	18,845.800	3.98%	571.694	575.948	1.01
TDC648	X4858	11/21/2020	0.8	17,626.000	4.05%	544.072	548.648	1.01
TDC648	X4863	11/21/2020	0.8	23,573.294	3.22%	590.460	583.675	0.99
TDC648	X4864	11/21/2020	0.8	18,891.785	3.22%	475.076	467.438	0.98
TDC648	X4865	11/21/2020	0.8	18,602.881	3.20%	464.272	456.801	0.98
TDC648	X4866X	11/21/2020	0.8	23,175.183	3.27%	572.548	582.151	1.02
TDC648	X4866Y	11/21/2020	0.8	11,907.571	3.15%	297.276	288.262	0.97
TDC648	X4867	11/21/2020	0.8	20,725.561	3.19%	514.472	508.565	0.99
TDC648	X4868	11/21/2020	0.8	14,837.085	3.18%	367.184	362.124	0.99
TDC648	X4859	11/21/2020	0.8	17,988.775	4.05%	557.105	560.009	1.01
TDC648	X4860	11/21/2020	0.8	24,074.823	3.97%	727.175	734.519	1.01
TDC648	X4861	11/21/2020	0.8	14,504.004	4.05%	449.616	451.808	1.00
TDC648	X4862	11/21/2020	0.8	15,302.206	3.93%	457.328	461.995	1.01
TDC648	X4869	11/21/2020	0.8	16,503.702	3.27%	429.217	415.023	0.97
TDC648	X4870	11/21/2020	0.8	18,278.417	3.29%	477.228	462.303	0.97

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TDC648	X4871	11/21/2020	0.8	19,827.091	3.27%	513.445	497.532	0.97
TDC814	Z1404	9/16/2020	0.8	19,597.338	3.88%	584.265	583.425	1.00
TDC814	Z1406	9/16/2020	0.8	22,781.948	3.86%	676.801	676.380	1.00
TDC814	Z1407	9/16/2020	0.8	22,681.399	3.85%	671.634	671.548	1.00
TDC814	Z1408	9/16/2020	0.8	27,936.993	3.86%	829.545	828.994	1.00
TDC814	Z1409	9/16/2020	0.8	24,136.505	3.86%	717.129	715.421	1.00
TDC814	Z1410	9/16/2020	0.8	22,365.446	3.87%	664.594	664.373	1.00
TDC814	Z1411	9/16/2020	0.8	21,568.582	3.87%	642.601	641.620	1.00
TDC814	Z1415	9/16/2020	0.8	24,674.706	3.86%	732.678	731.729	1.00
TSS117	C1732	11/21/2020	0.8	15,073.369	3.31%	395.430	383.830	0.97
TSS117	C1733	11/21/2020	0.8	16,379.636	3.30%	428.064	415.391	0.97
TSS117	C1734	11/21/2020	0.8	14,417.259	3.31%	377.787	366.700	0.97
TSS117	C1735	11/21/2020	0.8	11,471.176	3.31%	299.955	292.109	0.97
TSS117	C1736	11/21/2020	0.8	21,017.983	3.31%	549.864	533.875	0.97
TSS117	C1738	11/21/2020	0.8	11,991.622	3.32%	314.861	306.109	0.97
TSS117	C1720	11/21/2020	0.8	28,142.816	2.99%	656.325	646.744	0.99
TSS117	C1725	11/21/2020	0.8	9,711.905	3.05%	230.143	227.300	0.99
TSS117	C1728	11/21/2020	0.8	16,326.134	3.03%	385.758	380.201	0.99
TSS117	C1729	11/21/2020	0.8	18,443.717	3.00%	431.253	425.532	0.99
TSS117	C1730	11/21/2020	0.8	15,973.700	3.03%	376.366	371.399	0.99
TSS117	C1721	11/21/2020	0.8	16,347.010	3.78%	464.320	474.136	1.02
TSS117	C1722	11/21/2020	0.8	16,882.325	3.71%	469.103	480.755	1.02
TSS117	C1723	11/21/2020	0.8	20,033.955	3.65%	547.952	561.790	1.03
TSS117	C1724	11/21/2020	0.8	8,870.744	3.70%	246.076	252.129	1.02
TSS117	C1726	11/21/2020	0.8	18,357.288	3.72%	513.867	524.705	1.02
TSS117	C1727	11/21/2020	0.8	22,256.925	3.69%	615.162	631.411	1.03
TSS117	C1731	11/21/2020	0.8	19,872.832	3.76%	561.139	574.510	1.02
TSS140	J4071	8/28/2020	0.8	22,777.194	3.40%	589.442	594.876	1.01
TSS140	J4072	8/28/2020	0.8	19,155.080	3.44%	502.631	506.281	1.01
TSS140	J4073	8/28/2020	0.8	27,938.066	3.43%	737.134	736.769	1.00
TSS140	J4074	8/28/2020	0.8	13,885.779	3.41%	361.719	363.955	1.01
TSS140	J4075	8/28/2020	0.8	13,565.940	3.37%	351.606	351.202	1.00
TSS140	J4076	8/28/2020	0.8	23,357.555	3.41%	605.865	612.026	1.01
TSS140	J4081	8/28/2020	0.8	17,493.331	3.66%	488.426	491.588	1.01
TSS140	J4082	8/28/2020	0.8	20,787.875	3.62%	571.588	578.791	1.01
TSS140	J4083	8/28/2020	0.8	22,705.514	3.65%	638.087	636.102	1.00
TSS140	J4084	8/28/2020	0.8	18,046.435	3.67%	503.822	509.097	1.01

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TSS140	J4085	8/28/2020	0.8	27,913.142	3.67%	777.308	786.335	1.01
TSS152	E5210	9/5/2020	0.8	11,945.170	2.62%	243.627	240.798	0.99
TSS152	E5213X	9/5/2020	0.8	16,870.523	2.58%	337.430	334.453	0.99
TSS152	E5213Y	9/5/2020	0.8	11,385.510	2.64%	235.070	230.899	0.98
TSS152	E5215X	9/5/2020	0.8	15,893.194	2.56%	317.761	312.574	0.98
TSS152	E5215Y	9/5/2020	0.8	11,195.587	2.59%	226.618	222.448	0.98
TSS152	E5216	9/5/2020	0.8	12,274.788	2.59%	247.008	244.433	0.99
TSS152	E5217	9/5/2020	0.8	20,305.978	2.63%	415.762	409.518	0.98
TSS152	E5219	9/5/2020	0.8	20,321.700	2.62%	417.317	409.504	0.98
TSS152	E522	9/5/2020	0.8	17,143.863	2.54%	334.031	334.090	1.00
TSS152	E5222	9/5/2020	0.8	21,030.099	2.62%	428.669	423.030	0.99
TSS152	E526	9/5/2020	0.8	20,658.159	2.63%	425.029	417.055	0.98
TSS152	E5214	9/5/2020	0.8	15,129.106	3.10%	364.360	360.382	0.99
TSS152	E5218	9/5/2020	0.8	9,033.496	3.05%	219.992	211.465	0.96
TSS152	E5223X	9/5/2020	0.8	17,902.435	3.10%	434.336	425.948	0.98
TSS152	E5223Y	9/5/2020	0.8	20,186.230	3.10%	489.761	480.282	0.98
TSS152	E523	9/5/2020	0.8	13,303.382	3.09%	319.788	316.229	0.99
TSS152	E524	9/5/2020	0.8	11,398.254	3.10%	278.788	271.586	0.97
TSS152	E525X	9/5/2020	0.8	14,791.620	3.09%	360.816	351.198	0.97
TSS152	E525Y	9/5/2020	0.8	13,351.495	3.08%	323.447	316.369	0.98
TSS152	E521	9/5/2020	0.8	24,782.731	2.57%	502.996	488.751	0.97
TSS152	E5212	9/5/2020	0.8	21,670.372	2.62%	444.593	435.457	0.98
TSS152	E5220	9/5/2020	0.8	14,642.547	2.59%	296.613	291.041	0.98
TSS152	E5221X	9/5/2020	0.8	20,340.907	2.63%	420.938	411.168	0.98
TSS152	E5221Y	9/5/2020	0.8	15,927.412	2.58%	320.931	316.163	0.99
TSS152	E520X	9/5/2020	0.8	22,993.080	3.08%	558.152	543.535	0.97
TSS152	E520Y	9/5/2020	0.8	21,676.335	3.05%	520.754	507.412	0.97
TSS152	E5211	9/5/2020	0.8	15,615.433	3.09%	375.760	370.198	0.99
TSS152	E527	9/5/2020	0.8	25,751.430	3.01%	616.132	595.896	0.97
TSS152	E528	9/5/2020	0.8	20,300.475	3.05%	487.178	476.279	0.98
TSS152	E529	9/5/2020	0.8	15,307.569	3.09%	367.414	363.577	0.99
TSS41	Z4131	3/30/2020	0.8	22,941.087	3.05%	535.986	536.871	1.00
TSS41	Z4133	3/30/2020	0.8	21,522.634	3.09%	510.160	510.644	1.00
TSS41	Z4134	3/30/2020	0.8	20,748.894	3.04%	484.767	485.316	1.00
TSS41	Z4135	3/30/2020	0.8	17,364.742	3.06%	408.895	408.347	1.00
TSS41	Z4136	3/30/2020	0.8	15,004.394	3.06%	354.555	352.521	0.99
TSS41	Z4140	3/30/2020	0.8	15,461.307	3.06%	363.765	363.658	1.00

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TSS41	Z4141	3/30/2020	0.8	22,232.875	3.07%	525.623	524.817	1.00
TSS41	Z4142	3/30/2020	0.8	19,893.600	3.04%	463.686	463.955	1.00
TSS41	Z4143	3/30/2020	0.8	18,215.418	3.04%	429.025	426.015	0.99
TSS41	Z4144	3/30/2020	0.8	26,228.462	3.06%	616.545	616.209	1.00
TSS41	Z4145	3/30/2020	0.8	18,799.961	3.06%	441.308	441.488	1.00
TSS41	Z4147	3/30/2020	0.8	12,689.757	3.07%	300.243	299.382	1.00
TSS41	Z4148	3/30/2020	0.8	5,218.242	3.06%	122.836	122.590	1.00
TSS41	Z4137	3/30/2020	0.8	4,662.646	3.07%	110.534	110.094	1.00
TSS41	Z4138	3/30/2020	0.8	18,640.956	2.99%	429.524	428.885	1.00
TSS41	Z4139	3/30/2020	0.8	26,326.671	3.08%	625.400	622.382	1.00
TSS51	D513	11/1/2020	0.8	22,783.287	2.78%	474.654	486.809	1.03
TSS51	D514	11/1/2020	0.8	20,801.886	2.86%	446.091	456.280	1.02
TSS51	D519	11/1/2020	0.8	12,522.649	2.78%	262.422	267.861	1.02
TSS51	D510	11/1/2020	0.8	24,607.113	2.77%	510.871	524.280	1.03
TSS51	D511	11/1/2020	0.8	24,577.605	2.77%	508.806	522.648	1.03
TSS51	D518	11/1/2020	0.8	3,734.181	2.89%	81.011	82.804	1.02
TSS51	D5108	11/1/2020	0.8	19,104.719	2.78%	397.821	407.958	1.03
TSS51	D512	11/1/2020	0.8	18,514.192	2.86%	424.117	406.315	0.96
TSS51	D517	11/1/2020	0.8	23,402.181	2.74%	481.358	493.337	1.02
TSS51	D5107	11/1/2020	0.8	22,659.642	2.80%	478.323	487.828	1.02
TSS51	D515	11/1/2020	0.8	15,339.056	2.76%	318.674	325.596	1.02
TSS51	D516	11/1/2020	0.8	14,794.860	2.76%	307.984	313.748	1.02
TSS52	D524	8/29/2020	0.8	20,181.965	3.21%	494.265	497.719	1.01
TSS52	D5271	8/29/2020	0.8	21,650.369	3.21%	535.505	534.268	1.00
TSS52	D5278	8/29/2020	0.8	13,306.028	3.20%	325.425	326.823	1.00
TSS52	D5279	8/29/2020	0.8	14,018.133	3.30%	352.029	355.023	1.01
TSS52	D521	8/29/2020	0.8	28,793.169	3.19%	704.499	706.512	1.00
TSS52	D523	8/29/2020	0.8	19,961.598	3.15%	480.541	483.761	1.01
TSS52	D5270	8/29/2020	0.8	1,808.288	3.08%	43.747	42.848	0.98
TSS52	D5275	8/29/2020	0.8	15,918.190	3.20%	388.620	391.820	1.01
TSS52	D522	8/29/2020	0.8	20,698.217	3.19%	504.369	507.674	1.01
TSS52	D525	8/29/2020	0.8	30,651.234	3.16%	744.587	743.540	1.00
TSS52	D526	8/29/2020	0.8	18,487.722	3.17%	449.808	449.609	1.00
TSS52	D5276	8/29/2020	0.8	14,994.708	3.19%	366.051	367.637	1.00
TSS56	W5606	11/21/2020	0.8	8,964.612	2.98%	203.722	205.542	1.01
TSS56	W5612	11/21/2020	0.8	17,654.974	3.07%	414.801	416.288	1.00
TSS56	W5616	11/21/2020	0.8	25,986.887	3.03%	598.268	604.116	1.01



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TSS56	W562	11/21/2020	0.8	13,159.593	3.03%	303.461	306.365	1.01
TSS56	W560	11/21/2020	0.8	24,120.590	1.97%	395.555	365.918	0.93
TSS56	W5611	11/21/2020	0.8	24,413.151	1.94%	391.809	364.304	0.93
TSS56	W5613	11/21/2020	0.8	23,054.367	1.97%	375.117	348.731	0.93
TSS56	W5610	11/21/2020	0.8	24,026.022	3.13%	568.822	578.554	1.02
TSS56	W563	11/21/2020	0.8	20,891.794	3.15%	498.395	506.362	1.02
TSS56	W564	11/21/2020	0.8	18,886.931	3.13%	448.934	454.460	1.01
TSS56	W565	11/21/2020	0.8	24,409.380	3.15%	578.340	589.968	1.02
TSS56	W561	11/21/2020	0.8	20,059.491	2.40%	395.651	369.432	0.93
TSS56	W5615	11/21/2020	0.8	20,653.210	2.44%	412.717	386.782	0.94
TSS56	W5618	11/21/2020	0.8	33,803.326	2.44%	678.818	634.764	0.94
TSS56	W5619	11/21/2020	0.8	24,838.478	2.43%	495.216	462.961	0.93
TSS57	D571	11/1/2020	0.8	17,064.720	3.89%	540.077	509.325	0.94
TSS57	D5731	11/1/2020	0.8	16,486.392	3.85%	511.130	487.940	0.95
TSS57	D5732	11/1/2020	0.8	11,215.994	3.87%	351.068	333.106	0.95
TSS57	D5771	11/1/2020	0.8	16,422.681	3.88%	511.774	489.219	0.96
TSS57	D5772	11/1/2020	0.8	3,083.576	3.90%	96.973	92.318	0.95
TSS57	D5705	11/1/2020	0.8	14,185.774	3.88%	441.798	422.743	0.96
TSS57	D575	11/1/2020	0.8	20,479.838	3.82%	637.395	600.855	0.94
TSS57	D5773	11/1/2020	0.8	14,597.844	3.86%	466.654	433.160	0.93
TSS57	D5778	11/1/2020	0.8	13,087.767	3.85%	407.175	386.748	0.95
TSS57	D570X	11/1/2020	0.8	21,409.154	3.80%	655.230	624.341	0.95
TSS57	D570Y	11/1/2020	0.8	17,837.619	3.75%	538.771	513.514	0.95
TSS57	D5730	11/1/2020	0.8	22,284.533	3.71%	668.157	635.668	0.95
TSS57	D576	11/1/2020	0.8	31,524.532	3.79%	959.795	916.834	0.96
TSS57	D577	11/1/2020	0.8	12,720.003	3.82%	401.980	373.586	0.93
TSS57	D578	11/1/2020	0.8	17,756.110	3.74%	533.854	509.791	0.95
TSS60	G6071	11/8/2020	0.8	6,982.118	3.46%	190.152	185.704	0.98
TSS60	G6072	11/8/2020	0.8	19,138.919	3.51%	521.224	515.595	0.99
TSS60	G6073	11/8/2020	0.8	20,715.603	3.51%	565.144	558.551	0.99
TSS60	G6074	11/8/2020	0.8	22,870.055	3.50%	619.810	614.364	0.99
TSS60	G6075	11/8/2020	0.8	15,033.426	3.50%	413.937	404.336	0.98
TSS60	G6085	11/8/2020	0.8	13,985.316	4.05%	434.269	435.368	1.00
TSS60	G6086	11/8/2020	0.8	22,292.634	4.06%	690.506	695.502	1.01
TSS60	G6087	11/8/2020	0.8	17,064.847	4.05%	529.561	531.267	1.00
TSS60	G6088	11/8/2020	0.8	16,273.467	4.02%	500.162	503.103	1.01
TSS60	G6089	11/8/2020	0.8	20,929.530	4.07%	650.870	653.814	1.00

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TSS60	G6076	11/8/2020	0.8	22,873.941	3.50%	611.119	615.074	1.01
TSS60	G6077	11/8/2020	0.8	21,584.796	3.53%	581.749	584.806	1.01
TSS60	G6078	11/8/2020	0.8	18,695.829	3.55%	509.478	510.068	1.00
TSS60	G6081	11/8/2020	0.8	20,318.912	3.55%	552.303	554.482	1.00
TSS60	G6082	11/8/2020	0.8	14,724.348	3.57%	402.719	403.272	1.00
TSS60	G6083	11/8/2020	0.8	19,224.629	3.55%	523.625	523.698	1.00
TSS60	G6084	11/8/2020	0.8	16,578.132	3.56%	452.315	454.019	1.00
TSS60	G6091	11/8/2020	0.8	17,678.310	4.14%	550.411	561.991	1.02
TSS60	G6092	11/8/2020	0.8	20,209.103	4.15%	594.235	644.797	1.09
TSS60	G6093	11/8/2020	0.8	14,679.314	4.13%	457.626	465.434	1.02
TSS60	G6094	11/8/2020	0.8	13,549.561	4.14%	424.328	430.780	1.02
TSS60	G6095	11/8/2020	0.8	20,583.164	4.13%	640.056	652.947	1.02
TSS60	G6096	11/8/2020	0.8	3,935.231	4.15%	123.173	125.400	1.02
TSS60	G6097	11/8/2020	0.8	20,442.945	4.15%	640.430	651.597	1.02
TSS63	Z6333	10/23/2020	0.8	17,100.298	3.18%	419.920	418.297	1.00
TSS63	Z6334	10/23/2020	0.8	28,290.660	3.18%	691.447	690.457	1.00
TSS63	Z6335	10/23/2020	0.8	6,871.930	3.08%	202.330	162.619	0.80
TSS63	Z6339	10/23/2020	0.8	4,032.635	3.23%	103.609	100.017	0.97
TSS63	Z6340	10/23/2020	0.8	16,459.932	3.19%	404.237	403.892	1.00
TSS63	Z6342	10/23/2020	0.8	24,693.643	3.15%	599.171	598.005	1.00
TSS63	Z6336	10/23/2020	0.8	17,028.782	3.27%	426.854	427.910	1.00
TSS63	Z6337	10/23/2020	0.8	21,315.909	3.26%	532.336	533.496	1.00
TSS63	Z6338	10/23/2020	0.8	25,318.317	3.15%	615.104	613.532	1.00
TSS63	Z6343	10/23/2020	0.8	36,379.829	3.21%	903.198	898.522	0.99
TSS63	Z6344	10/23/2020	0.8	24,223.584	3.20%	599.008	595.516	0.99
TSS63	Z6345	10/23/2020	0.8	19,248.981	3.26%	483.230	482.245	1.00
TSS63	Z6330	10/23/2020	0.8	32,966.440	3.56%	911.352	901.661	0.99
TSS63	Z6331	10/23/2020	0.8	29,550.005	3.57%	823.878	811.073	0.98
TSS63	Z6332	10/23/2020	0.8	19,839.437	3.55%	548.241	541.029	0.99
TSS63	Z6352	10/23/2020	0.8	32,447.766	3.56%	904.063	887.613	0.98
TSS63	Z6353	10/23/2020	0.8	20,506.120	3.46%	559.573	544.947	0.97
TSS63	Z6354	10/23/2020	0.8	12,325.074	3.56%	341.407	336.668	0.99
TSS63	Z6349	10/23/2020	0.8	24,257.359	3.55%	668.791	661.558	0.99
TSS63	Z6350	10/23/2020	0.8	22,076.246	3.57%	608.372	605.431	1.00
TSS63	Z6351	10/23/2020	0.8	20,760.294	3.46%	565.489	552.588	0.98
TSS63	Z6346	10/23/2020	0.8	20,576.949	3.53%	567.391	557.946	0.98
TSS63	Z6347	10/23/2020	0.8	23,706.826	3.48%	647.374	633.891	0.98

Substation	Feeder	VO Go Live	CVRf	Energy Baseline (MWh)	Average Voltage Reduction* (%)	Ex Ante Energy Savings (MWh)	Verified Energy Savings (MWh)	Energy Realization Rate
TSS63	Z6348	10/23/2020	0.8	10,958.805	3.55%	304.584	299.287	0.98
TSS79	W792	11/21/2020	0.8	14,449.117	3.62%	381.994	402.192	1.05
TSS79	W7931	11/21/2020	0.8	13,773.940	4.23%	444.881	447.827	1.01
TSS79	W7934	11/21/2020	0.8	34,875.045	4.24%	1,167.532	1,137.067	0.97
TSS79	W7932	11/21/2020	0.8	29,559.713	4.24%	946.830	961.959	1.02
TSS79	W7935	11/21/2020	0.8	24,152.175	3.73%	653.329	692.805	1.06
TSS79	W7936	11/21/2020	0.8	48,708.368	3.73%	1,321.515	1,395.125	1.06
TSS79	W7937	11/21/2020	0.8	1,920.637	3.63%	51.420	53.502	1.04
TSS79	W7938	11/21/2020	0.8	21,599.995	3.74%	586.023	620.457	1.06
TSS85	C8511	11/21/2020	0.8	9,615.538	4.44%	343.097	328.302	0.96
TSS85	C8512	11/21/2020	0.8	16,273.442	4.49%	568.255	561.359	0.99
TSS85	C8513	11/21/2020	0.8	17,925.832	4.50%	625.352	620.366	0.99
TSS85	C8516	11/21/2020	0.8	28,031.501	4.49%	976.747	967.654	0.99
TSS85	C8517	11/21/2020	0.8	25,094.915	4.51%	881.464	869.575	0.99
TSS85	C8518	11/21/2020	0.8	26,473.568	4.49%	919.093	912.513	0.99
TSS85	C8510	11/21/2020	0.8	30,087.750	5.00%	1,161.347	1,156.318	1.00
TSS85	C8521	11/21/2020	0.8	23,126.222	4.98%	889.657	884.701	0.99
TSS85	C8525	11/21/2020	0.8	24,016.199	5.02%	930.609	926.565	1.00
TSS85	C8514	11/21/2020	0.8	24,694.521	4.50%	860.307	853.928	0.99
TSS85	C8515	11/21/2020	0.8	23,296.930	4.48%	812.862	801.513	0.99
TSS85	C8520	11/21/2020	0.8	5,521.028	4.48%	192.053	190.061	0.99
TSS85	C8523	11/21/2020	0.8	18,057.557	4.53%	635.619	628.712	0.99
TSS85	C8522	11/21/2020	0.8	22,247.300	5.06%	867.250	864.749	1.00
TSS85	C8527	11/21/2020	0.8	11,949.372	5.05%	464.954	463.932	1.00
TSS85	C8528	11/21/2020	0.8	27,414.010	5.05%	1,066.132	1,063.158	1.00
TSS85	C8530	11/21/2020	0.8	24,328.263	5.06%	940.145	945.487	1.01
TSS85	C8533	11/21/2020	0.8	21,534.175	5.06%	834.808	837.039	1.00
<b>Total</b>						<b>216,582.437</b>	<b>215,966.316</b>	<b>1.00</b>

\* The average voltage reduction is weighted by load.

Source: Evaluation team analysis

**Table B-2. CY2020 Verified VO Demand Savings and Peak Voltage Reductions by Feeder**

Substation	Feeder	VO Go Live	CVRf <sub>Peak</sub>	Demand Baseline (MW)	Average Voltage Reduction* (%)	Ex Ante Demand Savings (MW)	Verified Demand Savings (MW)	Demand Realization Rate
DCB51	B511	8/28/2020	1.02	5.293	3.24%	0.196	0.168	0.86
DCB51	B518	9/29/2020	1.02	2.612	4.67%	0.116	0.119	1.03

Substation	Feeder	VO Go Live	CVR <sub>fPeak</sub>	Demand Baseline (MW)	Average Voltage Reduction* (%)	Ex Ante Demand Savings (MW)	Verified Demand Savings (MW)	Demand Realization Rate
DCC21	C211	6/3/2020	1.02	1.474	3.52%	0.053	0.051	0.97
DCC33	C339	8/28/2020	1.02	3.262	4.27%	0.140	0.137	0.98
DCC85	C858	9/5/2020	1.02	3.110	4.38%	0.136	0.134	0.98
DCD47	D4701	7/27/2020	1.02	3.499	4.33%	0.156	0.149	0.95
DCE82	E821	7/27/2020	1.02	4.802	4.92%	0.253	0.231	0.91
DCF17	F176	11/21/2020	1.02	3.765	4.59%	0.178	0.169	0.95
DCG909	G091	6/9/2020	1.02	1.267	4.13%	0.052	0.051	0.99
DCH23	H235	7/27/2020	1.02	2.442	2.72%	0.084	0.065	0.77
DCH23	H236	7/27/2020	1.02	3.515	5.66%	0.188	0.195	1.04
DCH65	H651	11/16/2020	1.02	3.779	4.46%	0.177	0.165	0.93
DCH70	H706	4/16/2020	1.02	1.346	4.79%	0.065	0.063	0.97
DCH70	H705	1/13/2020	1.02	1.809	5.17%	0.093	0.092	0.98
DCJ92	J925	2/14/2020	1.02	4.235	4.00%	0.171	0.166	0.97
DCJ92	J926	2/14/2020	1.02	3.177	3.93%	0.136	0.122	0.90
DCS63	S635	10/31/2020	1.02	2.224	4.07%	0.096	0.089	0.92
DCW211	W111	7/27/2020	1.02	3.754	4.79%	0.184	0.176	0.96
DCW211	W112	7/27/2020	1.02	4.196	4.07%	0.183	0.167	0.92
DCW334	W341	9/29/2020	1.02	4.192	4.71%	0.201	0.193	0.96
DCW51	W513	6/17/2020	1.02	4.783	4.21%	0.208	0.197	0.95
TDC215	C1510	6/25/2020	1.02	4.307	2.60%	0.112	0.110	0.98
TDC215	C1511	6/25/2020	1.02	3.273	2.61%	0.085	0.084	0.98
TDC215	C1512	6/25/2020	1.02	3.000	2.65%	0.081	0.078	0.97
TDC215	C1513	6/25/2020	1.02	1.274	2.63%	0.033	0.033	0.98
TDC215	C1517	6/25/2020	1.02	3.083	2.62%	0.081	0.079	0.98
TDC215	C1514	6/25/2020	1.02	3.253	2.70%	0.088	0.086	0.97
TDC215	C1515	6/25/2020	1.02	2.605	2.67%	0.069	0.068	0.98
TDC215	C1516	6/25/2020	1.02	3.539	2.68%	0.094	0.093	0.98
TDC215	C1518	6/25/2020	1.02	1.419	2.71%	0.039	0.038	0.97
TDC215	C1520	6/25/2020	1.02	3.599	2.70%	0.098	0.095	0.98
TDC220	E2005	9/29/2020	1.02	3.388	3.57%	0.121	0.118	0.98
TDC220	E2006	9/29/2020	1.02	4.057	3.54%	0.143	0.141	0.99
TDC220	E2007	9/29/2020	1.02	4.028	3.58%	0.143	0.141	0.99
TDC220	E2008	9/29/2020	1.02	4.323	3.61%	0.156	0.153	0.98
TDC220	E2009	9/29/2020	1.02	3.584	3.55%	0.126	0.125	0.99
TDC220	E2010	9/29/2020	1.02	3.729	3.55%	0.132	0.130	0.98
TDC220	E2016	9/29/2020	1.02	3.834	4.30%	0.163	0.162	0.99

Substation	Feeder	VO Go Live	CVR <sub>fPeak</sub>	Demand Baseline (MW)	Average Voltage Reduction* (%)	Ex Ante Demand Savings (MW)	Verified Demand Savings (MW)	Demand Realization Rate
TDC220	E2018	9/29/2020	1.02	1.839	4.32%	0.079	0.078	0.99
TDC220	E2019	9/29/2020	1.02	2.098	4.31%	0.089	0.089	0.99
TDC220	E2020	9/29/2020	1.02	3.125	4.31%	0.133	0.132	0.99
TDC220	E2021	9/29/2020	1.02	2.570	4.32%	0.110	0.109	0.99
TDC220	E2012	9/29/2020	1.02	3.505	3.40%	0.117	0.117	0.99
TDC220	E2013	9/29/2020	1.02	4.864	3.48%	0.176	0.166	0.94
TDC220	E2014	9/29/2020	1.02	2.805	3.41%	0.094	0.094	0.99
TDC220	E2015	9/29/2020	1.02	3.516	3.44%	0.120	0.118	0.99
TDC221	E2101	10/31/2020	1.02	3.408	4.18%	0.150	0.140	0.93
TDC221	E2102	10/31/2020	1.02	4.091	4.18%	0.176	0.168	0.95
TDC221	E2103	10/31/2020	1.02	2.145	4.18%	0.092	0.088	0.95
TDC221	E2104	10/31/2020	1.02	4.428	4.21%	0.196	0.182	0.93
TDC221	E2105	10/31/2020	1.02	3.023	3.92%	0.120	0.116	0.97
TDC221	E2106	10/31/2020	1.02	3.118	3.94%	0.129	0.120	0.94
TDC221	E2107	10/31/2020	1.02	3.171	3.91%	0.124	0.121	0.98
TDC221	E2108	10/31/2020	1.02	3.967	3.93%	0.158	0.153	0.97
TDC221	E2109	10/31/2020	1.02	3.705	3.92%	0.148	0.142	0.96
TDC221	E2110	10/31/2020	1.02	0.876	3.92%	0.035	0.034	0.95
TDC222	C2215	11/8/2020	1.02	2.772	4.59%	0.130	0.125	0.96
TDC222	C2217	11/8/2020	1.02	3.878	4.60%	0.183	0.175	0.95
TDC222	C2218	11/8/2020	1.02	4.989	4.61%	0.234	0.225	0.96
TDC222	C2211	11/8/2020	1.02	2.727	3.22%	0.089	0.086	0.96
TDC222	C2212	11/8/2020	1.02	2.118	3.22%	0.070	0.067	0.96
TDC222	C2214	11/8/2020	1.02	4.197	3.20%	0.136	0.131	0.96
TDC222	C2220	11/8/2020	1.02	5.011	3.15%	0.168	0.155	0.92
TDC240	E4001	9/29/2020	1.02	3.241	4.16%	0.129	0.132	1.03
TDC240	E4002	9/29/2020	1.02	3.305	4.14%	0.131	0.134	1.02
TDC240	E4003	9/29/2020	1.02	3.435	4.15%	0.136	0.140	1.03
TDC240	E4004	9/29/2020	1.02	2.339	4.17%	0.094	0.095	1.02
TDC240	E4005	9/29/2020	1.02	2.936	4.33%	0.119	0.125	1.05
TDC240	E4006	9/29/2020	1.02	3.311	4.34%	0.134	0.141	1.05
TDC240	E4007	9/29/2020	1.02	3.424	4.32%	0.138	0.145	1.05
TDC240	E4008	9/29/2020	1.02	5.248	4.34%	0.216	0.223	1.03
TDC260	E6020	8/28/2020	1.02	4.182	3.16%	0.133	0.129	0.98
TDC260	E6021	8/28/2020	1.02	3.566	3.18%	0.115	0.111	0.96
TDC260	E6022	8/28/2020	1.02	4.702	3.18%	0.153	0.147	0.96

Substation	Feeder	VO Go Live	CVR <sub>fPeak</sub>	Demand Baseline (MW)	Average Voltage Reduction* (%)	Ex Ante Demand Savings (MW)	Verified Demand Savings (MW)	Demand Realization Rate
TDC260	E6023X	8/28/2020	1.02	3.834	3.20%	0.124	0.120	0.97
TDC260	E6023Y	8/28/2020	1.02	0.751	3.21%	0.025	0.024	0.97
TDC260	E6024	8/28/2020	1.02	1.456	3.18%	0.046	0.045	0.98
TDC260	E6025	8/28/2020	1.02	4.884	3.26%	0.169	0.156	0.92
TDC260	E6026	8/28/2020	1.02	2.674	3.23%	0.091	0.085	0.93
TDC260	E6027	8/28/2020	1.02	4.475	3.26%	0.154	0.143	0.93
TDC260	E6028Y	8/28/2020	1.02	4.712	3.22%	0.161	0.149	0.92
TDC260	E6029	8/28/2020	1.02	3.674	3.26%	0.129	0.117	0.91
TDC268	E680X	11/18/2020	1.02	2.592	3.55%	0.092	0.090	0.98
TDC268	E680Y	11/18/2020	1.02	1.875	3.53%	0.066	0.065	0.99
TDC268	E6811	11/18/2020	1.02	1.160	3.53%	0.042	0.040	0.96
TDC268	E6815	11/18/2020	1.02	2.611	3.55%	0.093	0.091	0.98
TDC268	E6819	11/18/2020	1.02	3.478	3.54%	0.122	0.120	0.99
TDC268	E6821	11/18/2020	1.02	2.926	3.54%	0.102	0.101	0.99
TDC268	E684	11/18/2020	1.02	3.267	3.53%	0.116	0.113	0.98
TDC268	E688	11/18/2020	1.02	3.824	3.56%	0.136	0.133	0.98
TDC268	E689X	11/18/2020	1.02	2.761	3.55%	0.098	0.096	0.98
TDC268	E689Y	11/18/2020	1.02	3.146	3.56%	0.112	0.110	0.98
TDC268	E6810	11/18/2020	1.02	3.508	3.19%	0.110	0.110	1.00
TDC268	E681X	11/18/2020	1.02	2.253	3.20%	0.072	0.071	0.99
TDC268	E681Y	11/18/2020	1.02	2.562	3.19%	0.080	0.080	1.00
TDC268	E682	11/18/2020	1.02	2.787	3.20%	0.088	0.087	1.00
TDC268	E685	11/18/2020	1.02	4.312	3.19%	0.135	0.135	1.00
TDC268	E6812X	11/18/2020	1.02	2.008	3.55%	0.073	0.070	0.95
TDC268	E6812Y	11/18/2020	1.02	0.575	3.56%	0.021	0.020	0.97
TDC268	E6820	11/18/2020	1.02	3.595	3.56%	0.130	0.125	0.96
TDC268	E6823	11/18/2020	1.02	3.816	3.55%	0.137	0.133	0.97
TDC268	E686	11/18/2020	1.02	2.910	3.57%	0.106	0.102	0.96
TDC268	E6813	11/18/2020	1.02	3.361	3.24%	0.105	0.107	1.02
TDC268	E6814	11/18/2020	1.02	4.091	3.26%	0.131	0.131	1.00
TDC268	E6816X	11/18/2020	1.02	3.057	3.25%	0.097	0.097	1.01
TDC268	E6816Y	11/18/2020	1.02	3.681	3.26%	0.116	0.117	1.01
TDC268	E6817	11/18/2020	1.02	3.560	3.24%	0.115	0.113	0.98
TDC268	E6818	11/18/2020	1.02	2.649	3.24%	0.083	0.084	1.02
TDC268	E683X	11/18/2020	1.02	3.478	3.27%	0.111	0.111	1.00
TDC268	E687	11/18/2020	1.02	2.810	3.26%	0.088	0.090	1.02

Substation	Feeder	VO Go Live	CVR <sub>fPeak</sub>	Demand Baseline (MW)	Average Voltage Reduction* (%)	Ex Ante Demand Savings (MW)	Verified Demand Savings (MW)	Demand Realization Rate
TDC317	H1701	4/23/2020	1.02	4.151	3.27%	0.138	0.133	0.96
TDC317	H1702	4/23/2020	1.02	3.901	3.27%	0.134	0.125	0.94
TDC317	H1703	4/23/2020	1.02	1.078	3.28%	0.036	0.035	0.97
TDC416	J1670	11/21/2020	1.02	4.122	4.83%	0.195	0.195	1.00
TDC416	J1671	11/21/2020	1.02	3.839	4.84%	0.182	0.182	1.00
TDC416	J1672	11/21/2020	1.02	4.414	4.85%	0.210	0.210	1.00
TDC416	J1674	11/21/2020	1.02	3.761	4.84%	0.178	0.178	1.00
TDC416	J1676	11/21/2020	1.02	3.596	4.85%	0.170	0.171	1.00
TDC416	J1677	11/21/2020	1.02	4.439	4.83%	0.212	0.210	0.99
TDC416	J1678	11/21/2020	1.02	2.723	4.84%	0.129	0.129	1.00
TDC416	J1680	11/21/2020	1.02	3.781	4.87%	0.179	0.180	1.01
TDC416	J1681	11/21/2020	1.02	3.235	4.87%	0.154	0.154	1.00
TDC416	J1684	11/21/2020	1.02	2.389	4.87%	0.114	0.114	1.00
TDC419	G1971	10/23/2020	1.02	4.825	2.41%	0.107	0.114	1.06
TDC419	G1972	10/23/2020	1.02	2.727	2.42%	0.061	0.065	1.06
TDC419	G1973	10/23/2020	1.02	3.451	2.42%	0.077	0.082	1.06
TDC419	G1974	10/23/2020	1.02	3.042	2.39%	0.067	0.071	1.07
TDC419	G1975	10/23/2020	1.02	2.680	2.40%	0.059	0.063	1.06
TDC419	G1977X	10/23/2020	1.02	3.548	2.40%	0.078	0.083	1.07
TDC419	G1977Y	10/23/2020	1.02	3.557	2.41%	0.081	0.084	1.04
TDC419	G1978X	10/23/2020	1.02	3.340	2.41%	0.074	0.079	1.07
TDC419	G1978Y	10/23/2020	1.02	3.344	2.42%	0.075	0.079	1.06
TDC419	G1985	10/23/2020	1.02	3.389	3.49%	0.121	0.116	0.95
TDC419	G1986X	10/23/2020	1.02	3.091	3.49%	0.111	0.106	0.95
TDC419	G1986Y	10/23/2020	1.02	3.304	3.49%	0.118	0.113	0.96
TDC419	G1987	10/23/2020	1.02	3.568	3.49%	0.127	0.122	0.96
TDC419	G1988	10/23/2020	1.02	4.051	3.50%	0.146	0.139	0.96
TDC419	G1989	10/23/2020	1.02	3.551	3.49%	0.127	0.121	0.96
TDC419	G1990	10/23/2020	1.02	3.794	3.49%	0.137	0.130	0.94
TDC419	G1991	10/23/2020	1.02	4.641	3.49%	0.169	0.159	0.94
TDC419	G1992	10/23/2020	1.02	2.728	3.50%	0.097	0.094	0.97
TDC419	G1981X	10/23/2020	1.02	1.261	2.37%	0.028	0.029	1.06
TDC419	G1982	10/23/2020	1.02	4.773	2.35%	0.103	0.110	1.07
TDC419	G1983	10/23/2020	1.02	2.427	2.35%	0.054	0.056	1.05
TDC419	G1984	10/23/2020	1.02	3.571	2.38%	0.078	0.083	1.07
TDC419	G1993	10/23/2020	1.02	4.374	3.49%	0.157	0.149	0.95

Substation	Feeder	VO Go Live	CVR <sub>fPeak</sub>	Demand Baseline (MW)	Average Voltage Reduction* (%)	Ex Ante Demand Savings (MW)	Verified Demand Savings (MW)	Demand Realization Rate
TDC419	G1994	10/23/2020	1.02	1.160	3.48%	0.041	0.040	0.96
TDC419	G1995	10/23/2020	1.02	3.354	3.49%	0.122	0.115	0.94
TDC419	G1996	10/23/2020	1.02	2.647	3.47%	0.094	0.090	0.95
TDC419	G1997	10/23/2020	1.02	3.854	3.48%	0.138	0.131	0.95
TDC419	G1998	10/23/2020	1.02	4.396	3.48%	0.157	0.150	0.96
TDC451	J5111	9/13/2020	1.02	3.993	2.99%	0.128	0.117	0.92
TDC451	J5112	9/13/2020	1.02	3.436	3.01%	0.111	0.101	0.91
TDC451	J5114	9/13/2020	1.02	4.462	3.01%	0.143	0.131	0.92
TDC451	J5141	9/13/2020	1.02	3.411	3.01%	0.108	0.100	0.93
TDC451	J5184	9/13/2020	1.02	4.860	3.02%	0.158	0.144	0.91
TDC451	J5161	7/3/2020	1.02	4.210	2.81%	0.114	0.116	1.01
TDC451	J5181	7/3/2020	1.02	4.904	2.82%	0.136	0.136	1.00
TDC451	J5121	7/3/2020	1.02	3.709	2.81%	0.102	0.102	1.00
TDC451	J5152	7/3/2020	1.02	3.860	2.80%	0.105	0.106	1.00
TDC451	J5153	7/3/2020	1.02	4.035	2.80%	0.111	0.111	1.00
TDC451	J5154	7/3/2020	1.02	4.554	2.81%	0.126	0.125	0.99
TDC451	J5122	7/3/2020	1.02	4.740	2.95%	0.140	0.137	0.98
TDC451	J5123	7/3/2020	1.02	3.870	2.95%	0.114	0.112	0.98
TDC451	J5162	7/3/2020	1.02	3.289	2.95%	0.097	0.095	0.98
TDC451	J5131	7/3/2020	1.02	4.527	2.97%	0.136	0.132	0.96
TDC451	J5133	7/3/2020	1.02	4.246	2.97%	0.129	0.124	0.96
TDC451	J5134	7/3/2020	1.02	3.582	2.98%	0.108	0.104	0.97
TDC451	J5113	8/14/2020	1.02	4.254	3.50%	0.150	0.146	0.97
TDC451	J5124	8/14/2020	1.02	4.238	3.47%	0.147	0.144	0.98
TDC451	J5163	8/14/2020	1.02	3.822	3.47%	0.132	0.130	0.98
TDC451	J5164	8/14/2020	1.02	4.705	3.47%	0.164	0.160	0.98
TDC451	J5151	8/14/2020	1.02	4.830	3.48%	0.168	0.164	0.98
TDC451	J5171	8/14/2020	1.02	4.019	3.47%	0.139	0.137	0.98
TDC555	W553	11/16/2020	1.02	4.185	4.52%	0.184	0.185	1.01
TDC555	W554	11/16/2020	1.02	2.001	4.55%	0.089	0.089	1.00
TDC555	W556	11/16/2020	1.02	3.343	4.55%	0.148	0.149	1.01
TDC555	W557	11/16/2020	1.02	4.016	4.53%	0.178	0.178	1.00
TDC555	W558	11/16/2020	1.02	3.099	4.53%	0.137	0.138	1.01
TDC555	W550	11/16/2020	1.02	3.485	3.03%	0.095	0.104	1.09
TDC555	W551	11/16/2020	1.02	3.281	3.01%	0.089	0.097	1.09
TDC555	W5512	11/16/2020	1.02	3.310	3.03%	0.090	0.098	1.09



Substation	Feeder	VO Go Live	CVR <sub>fPeak</sub>	Demand Baseline (MW)	Average Voltage Reduction* (%)	Ex Ante Demand Savings (MW)	Verified Demand Savings (MW)	Demand Realization Rate
TDC555	W552	11/16/2020	1.02	2.950	3.04%	0.080	0.088	1.09
TDC555	W555	11/16/2020	1.02	1.669	3.01%	0.045	0.049	1.09
TDC555	W559	11/16/2020	1.02	3.761	3.00%	0.101	0.111	1.09
TDC557	W570	11/21/2020	1.02	2.091	4.28%	0.091	0.088	0.97
TDC557	W571	11/21/2020	1.02	3.607	4.31%	0.157	0.152	0.97
TDC557	W573	11/21/2020	1.02	4.032	4.27%	0.174	0.169	0.97
TDC557	W578	11/21/2020	1.02	2.808	4.29%	0.122	0.118	0.97
TDC557	W579	11/21/2020	1.02	4.143	4.28%	0.180	0.174	0.96
TDC557	W5710	11/21/2020	1.02	3.721	3.15%	0.115	0.115	1.00
TDC557	W574	11/21/2020	1.02	3.013	3.15%	0.092	0.093	1.00
TDC557	W575	11/21/2020	1.02	2.013	3.15%	0.063	0.062	0.99
TDC557	W576	11/21/2020	1.02	1.866	3.20%	0.059	0.059	0.99
TDC557	W577X	11/21/2020	1.02	1.991	3.14%	0.061	0.061	1.00
TDC557	W577Y	11/21/2020	1.02	3.063	3.16%	0.094	0.095	1.00
TDC648	X4851	11/21/2020	1.02	1.904	3.86%	0.074	0.072	0.98
TDC648	X4852	11/21/2020	1.02	2.181	3.85%	0.084	0.082	0.98
TDC648	X4853	11/21/2020	1.02	2.527	3.86%	0.097	0.095	0.98
TDC648	X4855	11/21/2020	1.02	4.047	3.86%	0.158	0.153	0.97
TDC648	X4856	11/21/2020	1.02	4.780	3.85%	0.185	0.180	0.98
TDC648	X4857	11/21/2020	1.02	3.482	3.85%	0.136	0.131	0.96
TDC648	X4858	11/21/2020	1.02	3.249	3.86%	0.126	0.123	0.97
TDC648	X4863	11/21/2020	1.02	4.677	2.91%	0.138	0.133	0.96
TDC648	X4864	11/21/2020	1.02	4.085	2.90%	0.122	0.116	0.95
TDC648	X4865	11/21/2020	1.02	4.185	2.90%	0.123	0.119	0.97
TDC648	X4866X	11/21/2020	1.02	4.229	2.90%	0.130	0.120	0.93
TDC648	X4866Y	11/21/2020	1.02	1.295	2.91%	0.039	0.037	0.94
TDC648	X4867	11/21/2020	1.02	3.485	2.91%	0.103	0.099	0.97
TDC648	X4868	11/21/2020	1.02	2.675	2.89%	0.079	0.076	0.96
TDC648	X4859	11/21/2020	1.02	4.051	3.84%	0.156	0.152	0.98
TDC648	X4860	11/21/2020	1.02	3.112	3.83%	0.119	0.117	0.98
TDC648	X4861	11/21/2020	1.02	3.234	3.84%	0.125	0.122	0.97
TDC648	X4862	11/21/2020	1.02	2.059	3.84%	0.079	0.077	0.98
TDC648	X4869	11/21/2020	1.02	3.677	3.08%	0.120	0.111	0.93
TDC648	X4870	11/21/2020	1.02	4.285	3.07%	0.140	0.129	0.92
TDC648	X4871	11/21/2020	1.02	4.078	3.07%	0.133	0.123	0.92
TDC814	Z1404	9/16/2020	1.02	3.599	4.01%	0.143	0.141	0.99

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TDC814	Z1406	9/16/2020	1.02	3.903	4.00%	0.155	0.153	0.98
TDC814	Z1407	9/16/2020	1.02	2.989	3.98%	0.118	0.117	0.98
TDC814	Z1408	9/16/2020	1.02	4.525	3.99%	0.180	0.177	0.98
TDC814	Z1409	9/16/2020	1.02	3.820	3.98%	0.153	0.149	0.97
TDC814	Z1410	9/16/2020	1.02	3.213	4.02%	0.129	0.126	0.98
TDC814	Z1411	9/16/2020	1.02	4.222	4.02%	0.169	0.166	0.99
TDC814	Z1415	9/16/2020	1.02	3.542	4.01%	0.141	0.139	0.99
TSS117	C1732	11/21/2020	1.02	3.554	3.15%	0.117	0.110	0.94
TSS117	C1733	11/21/2020	1.02	3.245	3.16%	0.105	0.100	0.95
TSS117	C1734	11/21/2020	1.02	3.264	3.15%	0.108	0.101	0.93
TSS117	C1735	11/21/2020	1.02	2.979	3.15%	0.096	0.092	0.95
TSS117	C1736	11/21/2020	1.02	4.201	3.16%	0.137	0.130	0.95
TSS117	C1738	11/21/2020	1.02	2.783	3.15%	0.090	0.086	0.95
TSS117	C1720	11/21/2020	1.02	3.405	2.96%	0.102	0.099	0.97
TSS117	C1725	11/21/2020	1.02	2.210	3.02%	0.067	0.065	0.98
TSS117	C1728	11/21/2020	1.02	2.923	3.02%	0.089	0.087	0.97
TSS117	C1729	11/21/2020	1.02	2.599	3.01%	0.079	0.077	0.98
TSS117	C1730	11/21/2020	1.02	3.246	3.00%	0.098	0.095	0.98
TSS117	C1721	11/21/2020	1.02	3.177	4.49%	0.137	0.140	1.02
TSS117	C1722	11/21/2020	1.02	2.917	4.55%	0.127	0.130	1.02
TSS117	C1723	11/21/2020	1.02	3.020	4.53%	0.131	0.134	1.02
TSS117	C1724	11/21/2020	1.02	1.330	4.49%	0.058	0.058	1.01
TSS117	C1726	11/21/2020	1.02	2.934	4.51%	0.127	0.130	1.02
TSS117	C1727	11/21/2020	1.02	3.526	4.51%	0.153	0.156	1.02
TSS117	C1731	11/21/2020	1.02	3.731	4.52%	0.164	0.165	1.01
TSS140	J4071	8/28/2020	1.02	4.549	2.81%	0.124	0.125	1.01
TSS140	J4072	8/28/2020	1.02	2.714	2.81%	0.075	0.075	1.00
TSS140	J4073	8/28/2020	1.02	3.411	2.88%	0.099	0.096	0.97
TSS140	J4074	8/28/2020	1.02	2.774	2.80%	0.075	0.076	1.01
TSS140	J4075	8/28/2020	1.02	2.788	2.79%	0.076	0.076	1.01
TSS140	J4076	8/28/2020	1.02	4.952	2.83%	0.138	0.137	0.99
TSS140	J4081	8/28/2020	1.02	3.549	3.20%	0.118	0.111	0.94
TSS140	J4082	8/28/2020	1.02	4.482	3.19%	0.146	0.140	0.96
TSS140	J4083	8/28/2020	1.02	4.694	3.22%	0.155	0.148	0.95
TSS140	J4084	8/28/2020	1.02	3.730	3.25%	0.127	0.119	0.93
TSS140	J4085	8/28/2020	1.02	4.876	3.26%	0.165	0.156	0.94

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TSS152	E5210	9/5/2020	1.02	1.555	1.84%	0.027	0.028	1.05
TSS152	E5213X	9/5/2020	1.02	3.218	1.75%	0.052	0.055	1.07
TSS152	E5213Y	9/5/2020	1.02	1.967	1.81%	0.033	0.035	1.05
TSS152	E5215X	9/5/2020	1.02	3.311	1.76%	0.053	0.057	1.07
TSS152	E5215Y	9/5/2020	1.02	2.289	1.81%	0.039	0.041	1.04
TSS152	E5216	9/5/2020	1.02	2.107	1.77%	0.034	0.037	1.06
TSS152	E5217	9/5/2020	1.02	3.697	1.79%	0.062	0.065	1.05
TSS152	E5219	9/5/2020	1.02	3.261	1.79%	0.055	0.057	1.05
TSS152	E522	9/5/2020	1.02	3.240	1.77%	0.053	0.056	1.06
TSS152	E5222	9/5/2020	1.02	3.931	1.82%	0.067	0.070	1.04
TSS152	E526	9/5/2020	1.02	3.282	1.82%	0.057	0.058	1.03
TSS152	E5214	9/5/2020	1.02	3.132	2.45%	0.076	0.075	0.99
TSS152	E5218	9/5/2020	1.02	1.248	2.51%	0.031	0.031	0.99
TSS152	E5223X	9/5/2020	1.02	3.326	2.50%	0.084	0.081	0.97
TSS152	E5223Y	9/5/2020	1.02	3.749	2.50%	0.094	0.092	0.97
TSS152	E523	9/5/2020	1.02	2.789	2.46%	0.070	0.067	0.97
TSS152	E524	9/5/2020	1.02	1.580	2.51%	0.040	0.039	0.97
TSS152	E525X	9/5/2020	1.02	2.348	2.51%	0.059	0.058	0.98
TSS152	E525Y	9/5/2020	1.02	2.903	2.42%	0.069	0.069	0.99
TSS152	E521	9/5/2020	1.02	3.971	1.83%	0.071	0.071	1.01
TSS152	E5212	9/5/2020	1.02	3.648	1.85%	0.064	0.066	1.03
TSS152	E5220	9/5/2020	1.02	2.476	1.83%	0.044	0.044	1.01
TSS152	E5221X	9/5/2020	1.02	3.244	1.84%	0.056	0.058	1.04
TSS152	E5221Y	9/5/2020	1.02	2.885	1.78%	0.048	0.050	1.05
TSS152	E520X	9/5/2020	1.02	3.569	2.51%	0.089	0.088	0.98
TSS152	E520Y	9/5/2020	1.02	3.233	2.50%	0.080	0.079	0.99
TSS152	E5211	9/5/2020	1.02	3.018	2.48%	0.075	0.073	0.98
TSS152	E527	9/5/2020	1.02	3.639	2.50%	0.091	0.089	0.98
TSS152	E528	9/5/2020	1.02	3.604	2.49%	0.089	0.088	0.98
TSS152	E529	9/5/2020	1.02	3.551	2.48%	0.090	0.086	0.96
TSS41	Z4131	3/30/2020	1.02	3.619	1.63%	0.060	0.058	0.96
TSS41	Z4133	3/30/2020	1.02	2.780	1.63%	0.046	0.044	0.97
TSS41	Z4134	3/30/2020	1.02	3.504	1.63%	0.058	0.056	0.97
TSS41	Z4135	3/30/2020	1.02	2.542	1.62%	0.042	0.040	0.96
TSS41	Z4136	3/30/2020	1.02	1.949	1.64%	0.033	0.031	0.94
TSS41	Z4140	3/30/2020	1.02	2.230	1.62%	0.037	0.035	0.96

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TSS41	Z4141	3/30/2020	1.02	3.135	1.62%	0.051	0.050	0.97
TSS41	Z4142	3/30/2020	1.02	3.387	1.61%	0.055	0.053	0.97
TSS41	Z4143	3/30/2020	1.02	3.112	1.63%	0.052	0.050	0.96
TSS41	Z4144	3/30/2020	1.02	3.801	1.66%	0.064	0.062	0.96
TSS41	Z4145	3/30/2020	1.02	2.972	1.62%	0.049	0.047	0.97
TSS41	Z4147	3/30/2020	1.02	1.752	1.65%	0.030	0.028	0.94
TSS41	Z4148	3/30/2020	1.02	0.791	1.63%	0.013	0.013	0.95
TSS41	Z4137	3/30/2020	1.02	0.605	1.66%	0.010	0.010	0.95
TSS41	Z4138	3/30/2020	1.02	3.691	1.61%	0.061	0.058	0.95
TSS41	Z4139	3/30/2020	1.02	3.541	1.66%	0.061	0.058	0.94
TSS51	D513	11/1/2020	1.02	3.975	1.91%	0.064	0.074	1.17
TSS51	D514	11/1/2020	1.02	3.599	1.93%	0.058	0.068	1.16
TSS51	D519	11/1/2020	1.02	2.520	1.93%	0.042	0.048	1.15
TSS51	D510	11/1/2020	1.02	4.938	1.92%	0.080	0.093	1.16
TSS51	D511	11/1/2020	1.02	4.792	1.91%	0.078	0.090	1.15
TSS51	D518	11/1/2020	1.02	0.433	1.88%	0.007	0.008	1.18
TSS51	D5108	11/1/2020	1.02	3.595	1.92%	0.058	0.067	1.15
TSS51	D512	11/1/2020	1.02	2.215	1.86%	0.035	0.040	1.15
TSS51	D517	11/1/2020	1.02	4.474	1.88%	0.070	0.082	1.18
TSS51	D5107	11/1/2020	1.02	3.721	1.89%	0.059	0.069	1.17
TSS51	D515	11/1/2020	1.02	2.799	1.90%	0.045	0.052	1.16
TSS51	D516	11/1/2020	1.02	2.977	1.94%	0.050	0.056	1.13
TSS52	D524	8/29/2020	1.02	3.913	2.22%	0.090	0.085	0.95
TSS52	D5271	8/29/2020	1.02	3.192	2.28%	0.077	0.071	0.93
TSS52	D5278	8/29/2020	1.02	2.740	2.21%	0.063	0.059	0.94
TSS52	D5279	8/29/2020	1.02	1.695	2.25%	0.039	0.037	0.95
TSS52	D521	8/29/2020	1.02	4.653	2.20%	0.107	0.100	0.94
TSS52	D523	8/29/2020	1.02	4.212	2.16%	0.094	0.089	0.95
TSS52	D5270	8/29/2020	1.02	0.460	2.15%	0.010	0.010	0.96
TSS52	D5275	8/29/2020	1.02	2.894	2.16%	0.065	0.061	0.94
TSS52	D522	8/29/2020	1.02	4.042	2.18%	0.092	0.086	0.94
TSS52	D525	8/29/2020	1.02	5.101	2.21%	0.119	0.110	0.93
TSS52	D526	8/29/2020	1.02	3.914	2.18%	0.092	0.083	0.90
TSS52	D5276	8/29/2020	1.02	3.085	2.18%	0.073	0.066	0.91
TSS56	W5606	11/21/2020	1.02	1.661	2.30%	0.038	0.037	1.00
TSS56	W5612	11/21/2020	1.02	3.560	2.34%	0.083	0.082	0.99

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TSS56	W5616	11/21/2020	1.02	4.438	2.32%	0.101	0.101	1.00
TSS56	W562	11/21/2020	1.02	2.278	2.35%	0.053	0.052	1.00
TSS56	W560	11/21/2020	1.02	4.373	1.24%	0.067	0.053	0.79
TSS56	W5611	11/21/2020	1.02	4.664	1.24%	0.069	0.057	0.83
TSS56	W5613	11/21/2020	1.02	3.396	1.21%	0.049	0.040	0.82
TSS56	W5610	11/21/2020	1.02	4.018	2.45%	0.096	0.096	1.01
TSS56	W563	11/21/2020	1.02	4.006	2.46%	0.096	0.097	1.01
TSS56	W564	11/21/2020	1.02	3.803	2.45%	0.091	0.091	1.00
TSS56	W565	11/21/2020	1.02	4.164	2.45%	0.099	0.100	1.01
TSS56	W561	11/21/2020	1.02	3.835	1.69%	0.074	0.064	0.86
TSS56	W5615	11/21/2020	1.02	3.678	1.70%	0.072	0.061	0.85
TSS56	W5618	11/21/2020	1.02	5.072	1.70%	0.099	0.084	0.86
TSS56	W5619	11/21/2020	1.02	4.858	1.70%	0.095	0.081	0.85
TSS57	D571	11/1/2020	1.02	3.082	3.57%	0.117	0.108	0.92
TSS57	D5731	11/1/2020	1.02	2.973	3.55%	0.111	0.103	0.93
TSS57	D5732	11/1/2020	1.02	1.546	3.66%	0.060	0.055	0.92
TSS57	D5771	11/1/2020	1.02	3.287	3.55%	0.123	0.114	0.93
TSS57	D5772	11/1/2020	1.02	0.490	3.68%	0.019	0.018	0.92
TSS57	D5705	11/1/2020	1.02	2.466	3.55%	0.093	0.086	0.92
TSS57	D575	11/1/2020	1.02	3.064	3.52%	0.116	0.106	0.91
TSS57	D5773	11/1/2020	1.02	2.011	3.60%	0.077	0.071	0.92
TSS57	D5778	11/1/2020	1.02	1.992	3.60%	0.076	0.070	0.92
TSS57	D570X	11/1/2020	1.02	3.485	3.44%	0.127	0.117	0.93
TSS57	D570Y	11/1/2020	1.02	3.456	3.36%	0.122	0.114	0.93
TSS57	D5730	11/1/2020	1.02	4.072	3.36%	0.143	0.134	0.94
TSS57	D576	11/1/2020	1.02	5.372	3.40%	0.192	0.179	0.93
TSS57	D577	11/1/2020	1.02	1.657	3.44%	0.070	0.056	0.80
TSS57	D578	11/1/2020	1.02	3.302	3.35%	0.115	0.108	0.94
TSS60	G6071	11/8/2020	1.02	1.152	3.25%	0.039	0.037	0.95
TSS60	G6072	11/8/2020	1.02	4.424	3.27%	0.148	0.142	0.95
TSS60	G6073	11/8/2020	1.02	4.368	3.27%	0.148	0.140	0.94
TSS60	G6074	11/8/2020	1.02	4.660	3.27%	0.154	0.149	0.97
TSS60	G6075	11/8/2020	1.02	2.825	3.26%	0.100	0.090	0.90
TSS60	G6085	11/8/2020	1.02	2.369	3.54%	0.084	0.082	0.98
TSS60	G6086	11/8/2020	1.02	4.611	3.55%	0.164	0.160	0.98
TSS60	G6087	11/8/2020	1.02	2.745	3.54%	0.097	0.095	0.98

Substation	Feeder	VO Go Live	CVR <sub>fPeak</sub>	Demand Baseline (MW)	Average Voltage Reduction* (%)	Ex Ante Demand Savings (MW)	Verified Demand Savings (MW)	Demand Realization Rate
TSS60	G6088	11/8/2020	1.02	3.084	3.54%	0.109	0.107	0.98
TSS60	G6089	11/8/2020	1.02	4.408	3.55%	0.160	0.153	0.96
TSS60	G6076	11/8/2020	1.02	4.183	3.28%	0.141	0.135	0.95
TSS60	G6077	11/8/2020	1.02	4.571	3.28%	0.153	0.147	0.96
TSS60	G6078	11/8/2020	1.02	4.476	3.29%	0.151	0.144	0.96
TSS60	G6081	11/8/2020	1.02	4.052	3.28%	0.137	0.130	0.95
TSS60	G6082	11/8/2020	1.02	3.619	3.29%	0.121	0.117	0.97
TSS60	G6083	11/8/2020	1.02	4.142	3.28%	0.145	0.133	0.92
TSS60	G6084	11/8/2020	1.02	3.469	3.30%	0.116	0.112	0.97
TSS60	G6091	11/8/2020	1.02	3.968	3.58%	0.140	0.139	0.99
TSS60	G6092	11/8/2020	1.02	4.412	3.57%	0.160	0.154	0.97
TSS60	G6093	11/8/2020	1.02	3.299	3.58%	0.118	0.116	0.98
TSS60	G6094	11/8/2020	1.02	2.775	3.57%	0.098	0.097	0.99
TSS60	G6095	11/8/2020	1.02	4.434	3.57%	0.157	0.155	0.99
TSS60	G6096	11/8/2020	1.02	0.631	3.57%	0.023	0.022	0.98
TSS60	G6097	11/8/2020	1.02	3.665	3.58%	0.132	0.129	0.98
TSS63	Z6333	10/23/2020	1.02	3.132	2.42%	0.077	0.074	0.97
TSS63	Z6334	10/23/2020	1.02	5.085	2.42%	0.124	0.121	0.97
TSS63	Z6335	10/23/2020	1.02	1.360	2.44%	0.034	0.032	0.97
TSS63	Z6339	10/23/2020	1.02	0.438	2.41%	0.011	0.010	0.94
TSS63	Z6340	10/23/2020	1.02	2.924	2.42%	0.072	0.069	0.97
TSS63	Z6342	10/23/2020	1.02	4.572	2.41%	0.112	0.108	0.97
TSS63	Z6336	10/23/2020	1.02	1.884	2.43%	0.046	0.045	0.97
TSS63	Z6337	10/23/2020	1.02	2.326	2.43%	0.057	0.055	0.97
TSS63	Z6338	10/23/2020	1.02	5.153	2.43%	0.126	0.122	0.97
TSS63	Z6343	10/23/2020	1.02	4.622	2.42%	0.114	0.110	0.96
TSS63	Z6344	10/23/2020	1.02	4.337	2.42%	0.107	0.103	0.96
TSS63	Z6345	10/23/2020	1.02	2.009	2.41%	0.049	0.048	0.97
TSS63	Z6330	10/23/2020	1.02	5.186	2.16%	0.132	0.110	0.83
TSS63	Z6331	10/23/2020	1.02	4.428	2.13%	0.116	0.092	0.79
TSS63	Z6332	10/23/2020	1.02	3.492	2.16%	0.089	0.074	0.83
TSS63	Z6352	10/23/2020	1.02	5.151	2.16%	0.134	0.109	0.82
TSS63	Z6353	10/23/2020	1.02	4.466	2.18%	0.114	0.096	0.84
TSS63	Z6354	10/23/2020	1.02	2.110	2.18%	0.053	0.045	0.84
TSS63	Z6349	10/23/2020	1.02	3.931	2.14%	0.100	0.082	0.82
TSS63	Z6350	10/23/2020	1.02	3.829	2.15%	0.098	0.081	0.82

Substation	Feeder	VO Go Live	CVR <sub>fPeak</sub>	Demand Baseline (MW)	Average Voltage Reduction* (%)	Ex Ante Demand Savings (MW)	Verified Demand Savings (MW)	Demand Realization Rate
TSS63	Z6351	10/23/2020	1.02	4.460	2.17%	0.114	0.095	0.83
TSS63	Z6346	10/23/2020	1.02	3.519	2.16%	0.092	0.074	0.81
TSS63	Z6347	10/23/2020	1.02	4.766	2.18%	0.124	0.102	0.82
TSS63	Z6348	10/23/2020	1.02	1.819	2.18%	0.047	0.039	0.82
TSS79	W792	11/21/2020	1.02	3.557	3.46%	0.061	0.121	1.96
TSS79	W7931	11/21/2020	1.02	2.942	3.99%	0.115	0.115	1.00
TSS79	W7934	11/21/2020	1.02	4.453	4.02%	0.197	0.175	0.89
TSS79	W7932	11/21/2020	1.02	5.408	4.01%	0.221	0.212	0.96
TSS79	W7935	11/21/2020	1.02	4.932	3.62%	0.162	0.175	1.08
TSS79	W7936	11/21/2020	1.02	6.658	3.63%	0.234	0.237	1.01
TSS79	W7937	11/21/2020	1.02	2.170	3.60%	0.072	0.077	1.07
TSS79	W7938	11/21/2020	1.02	3.725	3.62%	0.122	0.132	1.08
TSS85	C8511	11/21/2020	1.02	1.144	3.94%	0.046	0.044	0.96
TSS85	C8512	11/21/2020	1.02	3.394	3.94%	0.141	0.131	0.93
TSS85	C8513	11/21/2020	1.02	3.130	3.94%	0.126	0.121	0.96
TSS85	C8516	11/21/2020	1.02	4.009	3.94%	0.163	0.155	0.95
TSS85	C8517	11/21/2020	1.02	4.349	3.94%	0.182	0.168	0.92
TSS85	C8518	11/21/2020	1.02	3.790	3.95%	0.152	0.147	0.96
TSS85	C8510	11/21/2020	1.02	4.760	4.60%	0.223	0.214	0.96
TSS85	C8521	11/21/2020	1.02	3.892	4.60%	0.185	0.176	0.95
TSS85	C8525	11/21/2020	1.02	4.451	4.60%	0.208	0.201	0.97
TSS85	C8514	11/21/2020	1.02	3.818	3.95%	0.155	0.148	0.95
TSS85	C8515	11/21/2020	1.02	3.372	3.95%	0.137	0.130	0.96
TSS85	C8520	11/21/2020	1.02	1.301	3.95%	0.053	0.050	0.95
TSS85	C8523	11/21/2020	1.02	3.746	3.95%	0.151	0.145	0.96
TSS85	C8522	11/21/2020	1.02	3.809	4.65%	0.179	0.174	0.97
TSS85	C8527	11/21/2020	1.02	2.085	4.66%	0.098	0.095	0.97
TSS85	C8528	11/21/2020	1.02	4.636	4.65%	0.221	0.211	0.96
TSS85	C8530	11/21/2020	1.02	4.062	4.65%	0.190	0.185	0.98
TSS85	C8533	11/21/2020	1.02	3.755	4.64%	0.176	0.171	0.97
<b>Total</b>						<b>46.424</b>	<b>45.134</b>	<b>0.97</b>

\* The average voltage reduction is weighted by load.

Source: Evaluation team analysis

**Table B-3. CY2020 Verified VO Energy and Demand Realization Rates by Substation**

Substation	Ex Ante Energy Savings (MWh)	Verified Energy Savings (MWh)	Energy Realization Rate	Ex Ante Demand Savings (MW)	Verified Demand Savings (MW)	Demand Realization Rate
DCB51	1,647.891	1,644.089	1.00	0.312	0.287	0.92
DCC21	247.123	254.090	1.03	0.053	0.051	0.97
DCC33	492.249	491.291	1.00	0.140	0.137	0.98
DCC85	573.259	578.480	1.01	0.136	0.134	0.98
DCD47	516.000	513.975	1.00	0.156	0.149	0.95
DCE82	887.352	887.341	1.00	0.253	0.231	0.91
DCF17	731.602	736.500	1.01	0.178	0.169	0.95
DCG909	221.163	217.740	0.98	0.052	0.051	0.99
DCH23	1,040.998	1,045.413	1.00	0.272	0.260	0.95
DCH65	685.349	689.066	1.01	0.177	0.165	0.93
DCH70	709.974	708.443	1.00	0.159	0.155	0.98
DCJ92	1,356.550	1,352.656	1.00	0.307	0.288	0.94
DCS63	446.101	443.802	0.99	0.096	0.089	0.92
DCW211	1,375.922	1,385.309	1.01	0.367	0.343	0.94
DCW334	836.267	841.503	1.01	0.201	0.193	0.96
DCW51	739.055	763.064	1.03	0.208	0.197	0.95
TDC215	4,227.101	4,222.371	1.00	0.780	0.763	0.98
TDC220	7,327.862	7,366.476	1.01	1.903	1.871	0.98
TDC221	5,465.060	5,499.208	1.01	1.328	1.264	0.95
TDC222	5,051.258	5,129.213	1.02	1.010	0.963	0.95
TDC240	4,415.044	4,451.718	1.01	1.097	1.135	1.03
TDC260	6,036.831	5,897.694	0.98	1.299	1.226	0.94
TDC268	13,045.308	12,986.222	1.00	2.775	2.742	0.99
TDC317	1,437.379	1,471.092	1.02	0.308	0.293	0.95
TDC416	5,372.169	5,542.894	1.03	1.723	1.723	1.00
TDC419	11,417.269	11,174.983	0.98	2.802	2.772	0.99
TDC451	11,053.312	11,037.728	1.00	2.966	2.873	0.97
TDC555	5,721.605	5,869.049	1.03	1.236	1.285	1.04
TDC557	5,589.856	5,587.510	1.00	1.209	1.185	0.98
TDC648	10,654.838	10,625.912	1.00	2.465	2.368	0.96
TDC814	5,519.246	5,513.490	1.00	1.188	1.168	0.98
TSS117	7,863.425	7,848.626	1.00	1.985	1.955	0.98
TSS140	6,127.628	6,167.021	1.01	1.298	1.259	0.97
TSS152	11,331.072	11,111.741	0.98	1.851	1.865	1.01
TSS41	6,722.851	6,713.173	1.00	0.723	0.693	0.96
TSS51	4,692.132	4,775.463	1.02	0.645	0.748	1.16
TSS52	5,389.447	5,407.236	1.00	0.921	0.859	0.93



Substation	Ex Ante Energy Savings (MWh)	Verified Energy Savings (MWh)	Energy Realization Rate	Ex Ante Demand Savings (MW)	Verified Demand Savings (MW)	Demand Realization Rate
TSS56	6,759.626	6,594.550	0.98	1.180	1.097	0.93
TSS57	7,721.832	7,329.149	0.95	1.562	1.439	0.92
TSS60	12,179.201	12,275.968	1.01	2.993	2.885	0.96
TSS63	13,430.961	13,258.201	0.99	2.141	1.896	0.89
TSS79	5,553.523	5,710.936	1.03	1.184	1.243	1.05
TSS85	13,969.751	13,875.930	0.99	2.786	2.665	0.96
<b>Total</b>	<b>216,582.437</b>	<b>215,966.316</b>	<b>1.00</b>	<b>46.424</b>	<b>45.134</b>	<b>0.97</b>

Source: Evaluation team analysis

## Appendix C. Total Resource Cost Detail

Table C-1 shows the TRC cost-effectiveness analysis inputs available at the time of finalizing this impact evaluation report. Additional required cost data (e.g., measure costs, program-level incentive, and non-incentive costs) are not included in this table and will be provided to the evaluation team later.

**Table C-1. Total Resource Cost Savings Summary**

End Use Type	Research Category	Units	Quantity	EUL (years)*	ER Flag†	Gross Electric Energy Savings (kWh)	Gross Peak Demand Reduction (kW)	Gross Gas Savings (Therms)	Gross Secondary Savings due to Water Reduction (kWh)	Gross Heating Penalty (kWh)	Gross Heating Penalty (Therms)	NTG (kWh)	NTG (kW)	NTG (Therms)	Net Electric Energy Savings (kWh)	Net Peak Demand Reduction (kW)	Net Gas Savings (Therms)	Net Secondary Savings due to Water Reduction (kWh)	Net Heating Penalty (kWh)	Net Heating Penalty (Therms)
All	VO	Feeders	428	15.0	No	215,996,316	45,134	NA	NA	NA	NA	1.00	1.00	1.00	215,996,316	45,134	NA	NA	NA	NA
	Total			NA		215,996,316	45,134	0	0	0	0	NA	NA	NA	215,996,316	45,134	0	0	0	0

\* The total of the EUL column is the weighted average measure life (WAML) and is calculated as the sum product of the EUL and measure savings divided by total program savings.

† Early Replacement (ER) measures are flagged as YES, otherwise a NO is indicated in the column.

Source: ComEd tracking data and evaluation team analysis

## Appendix D. De-Rating Factor Calculation

To calculate a de-rating factor to account for times when VO is expected to be off for reasons that are within ComEd's control for each year of the 15 year measure life, ComEd reviewed the intended on-off VO cycling schedule versus the actual VO status logs and identified misalignments greater than a day (48 half hourly intervals). ComEd categorized each of these deviations as excludable or not-excludable based on the TRM.

ComEd identified misalignments between the schedule and the logs 7.18% of the time; this breaks down into 6.88% excludable and 0.30% not-excludable. Table D-1 shows this breakdown. Guidehouse applied the not-excludable percentage (0.3003%) as a de-rating factor to the annualized savings.

**Table D-1. Excludable and Not-Excludable Percentage of TRM Defined Categories**

Event	Category	Duration (half hourly intervals)	Percentage (%)
VO Control System	Excludable	30,362	1.78%
	Not-Excludable	0	0.00%
Loss of communication	Excludable	4,008	0.24%
	Not-Excludable	556	0.03%
System Operational Requirements	Excludable	82,789	4.86%
	Not-Excludable	0	0.00%
Equipment Issue	Excludable	0	0.00%
	Not-Excludable	4,560	0.27%
VO On-Off Cycling Schedule	Excludable	0	0.00%
Under Investigation	Not-Excludable	0	0.00%
Customer Maintenance	Excludable	0	0.00%
Summary	Not-Excludable	5,116	0.3003%
	Excludable	117,159	6.8763%

Source: ComEd