EXHIBIT 3 - REVENUES

2022 Cost of Service

Ottawa River Power Corp.
EB-2021-0052

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3.1 LOAD AND REVENUE FORECAST

3.1.1 INTRODUCTION

The evidence presented in this exhibit provides information supporting the revenues derived from activities regulated by the Ontario Energy Board (OEB). Actual operating revenues from regulated operations are derived mainly from fixed and variable tariff charges as well as pass through charges and specific service charges. Revenues are collected from seven (5) customer classes:

a) Residential;
b) General Service <50kW;
c) General Service 50 – 4,999 kW;
d) Unmetered Scattered Load (USL);
e) Sentinel Lighting; and
f) Street Lighting.

Ottawa River Power Corp. (ORPC) does not anticipate any changes to its customer classes (i.e. no addition or removal of a customer class.)

This exhibit also describes ORPC's load and customer forecasts. The load forecast methodology and assumptions are described in detail at 3.1.4 Load Forecast Methodology.

The evidence herein is organized per the following topics:

1) Revenue and Load Forecast;
2) Impact and Persistence from Historical CDM Programs;
3) Accuracy of Load Forecast and Variance Analysis; and
4) Other Revenues.

3.1.2 OVERVIEW OF CURRENT REVENUES

Table 1 - Revenues at Current Rates below shows revenues from current distribution charges for 2021.

Table 1 - Revenues at Current Rates

2021 Rates at 2022 Load

	Test Year Projected Revenue from Existing Variable Charges							
Customer Class Name	**Variable Distribution Rate**	**per**	**Test Year Volume**	**Gross Variable Revenue**	**Transform. Allowance Rate**	**Transform. Allowance kW's**	**Transform. Allowance $'s**	**Net Variable Revenue**
Residential	$0.0000	kWh	80,356,209	$0.00			$0.00	$0.00
GS<50 kW	$0.0135	kWh	29,645,117	$400,209.08			$0.00	$400,209.08
GS 50 to 4999 kW	$3.7003	kW	219,807	$813,350.63	-0.60	30565	-$18,339.00	$795,011.63
Sentinel Lighting	$9.6026	kW	495	$4,752.20			$0.00	$4,752.20
Street Lighting	$13.7739	kW	3,027	$41,694.36			$0.00	$41,694.36
Unmetered Scattered Load	$0.0037	kWh	606,879	$2,245.45			$0.00	$2,245.45
Other Class		kW	0	$0.00			$0.00	$0.00
Total Variable Revenue			**110,831,533**	**$1,262,251.73**		30565	-$18,339.00	$1,243,912.73

2021 Rates at 2022 Load

	Test Year Projected Revenue from Existing Fixed Charges							
Customer Class Name	**Fixed Rate**	**Customers (Connections)**	**Fixed Charge Revenue**	**Variable Revenue**	**TOTAL**	**% Fixed Revenue**	**% Variable Revenue**	**% Total Revenue**
Residential	$24.63	10,191	$3,012,117.35	$0.00	$3,012,116.98	100.00%		61.78%
GS<50 kW	$23.74	1,264	$360,092.64	$400,209.08	$760,301.72	47.36%	52.64%	15.59%
GS 50 to 4999 kW	$89.34	151	$161,848.39	$795,011.63	$956,860.01	16.91%	83.09%	19.63%
Sentinel Lighting	$3.11	166	$6,195.12	$4,752.20	$10,947.32	56.66%	43.34%	0.22%
Street Lighting	$2.51	2,949	$88,823.88	$41,694.36	$130,518.24	68.06%	31.94%	2.68%
Unmetered Scattered Load	$10.91	19	$2,487.48	$2,245.45	$4,732.93	52.56%	47.44%	0.10%
Other Class		0	$0.00	$0.00	$0.00			
Total Fixed Revenue		**14,741**	**$3,631,592.50**	**$1,243,912.73**	**$4,875,477.59**			

Distribution Revenues are derived from a combination of fixed monthly charges and volumetric charges applied to the utility's proposed Load Forecast:

- Fixed rate revenues are determined by applying the current fixed monthly charge to the number of customers or connections in each of the customer classes in each month.
- Variable rate revenue is based on a volumetric rate applied to meter readings for kWh consumption or kW demand volume.

ORPC's 2022 forecasted revenues recovered through its' current OEB-approved distribution rates are projected at $4,875,478 (exclusive of all rate riders). The revenues at proposed distribution rates are presented in Exhibit 6 and Exhibit 8.

A completed Appendix 2-IB Load Forecast Analysis has filed as Appendix A of this Exhibit 2. (Appendix 2-IB Load Forecast Analysis reconciles with worksheet 10 of the RRWF).

A copy of ORPC's Load Forecast including customers/connections, demand has been filed as Appendix B of Exhibit 2. ORPC does not expect or plan for any changes in the composition of its customer classes.

3.1.3 PROPOSED LOAD FORECAST

This section of the application covers:

a) the approach and methodology used to determine the load forecast.
b) the economic assumptions and data sources for customer and load forecasts.
c) an explanation of wholesale purchases and subsequent adjustments to the wholesale purchases.
d) the rationale behind each variable used in the regression analysis.
e) the regression results and how they were used to determine the forecast for the Bridge Year (2021) and Test Year (2022).

The table below illustrates the actual and forecast trends for customer/connection counts, kWh consumption and billed kW demand. The forecast trend has been used by ORPC to set its' proposed 2022 distribution rates.

Table 2 - Customer and Volume Trend Table

	Year	2016 Actuals	2017 Actuals	2018 Actuals	2019 Actuals	2020 Actuals	2021 Predicted	2022 Predicted
Residential	**Cust/Conn**	**9,506**	**9,600**	**9,741**	**9,857**	**9,959**	**10,074**	**10,191**
	kWh	**76,635,115**	**76,119,517**	**81,716,499**	**85,932,903**	**85,141,857**	**80,502,554**	**80,356,209**
	kW							
GS < 50 kW	**Cust/Conn**	**1,293**	**1,282**	**1,287**	**1,286**	**1,277**	**1,270**	**1,264**
	kWh	**29,514,061**	**28,872,534**	**30,060,062**	**30,767,208**	**26,233,400**	**29,699,107**	**29,645,117**
	kW							
GS > 50 to 4999 kW	**Cust/Conn**	**149**	**151**	**149**	**149**	**150**	**150**	**151**
	kWh	**75,048,053**	**70,829,349**	**71,502,339**	**73,532,152**	**65,161,090**	**71,123,260**	**70,993,966**
	kW	**223,174**	**218,669**	**229,114**	**230,501**	**216,593**	**220,207**	**219,807**
Sentinel	**Cust/Conn**	**182**	**178**	**178**	**175**	**171**	**169**	**166**
	kWh	**203,849**	**203,849**	**203,849**	**211,785**	**199,124**	**198,287**	**194,767**
	kW	**629**	**546**	**529**	**517**	**516**	**504**	**495**
Street Lighting	**Cust/Conn**	**2,822**	**2,840**	**2,878**	**2,897**	**2,905**	**2,927**	**2,949**
	kWh	**1,307,703**	**1,297,582**	**1,110,658**	**1,053,969**	**1,015,667**	**1,072,667**	**1,080,789**
	kW	**3,918**	**3,609**	**3,152**	**2,923**	**2,832**	**3,004**	**3,027**
USL	**Cust/Conn**	**19**	**19**	**19**	**19**	**19**	**19**	**19**

	kWh	**594,265**	**606,898**	**605,298**	**613,238**	**602,100**	**606,879**	**606,879**
	kW	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Total	**Cust/Conn**	**13,971**	**14,070**	**14,252**	**14,383**	**14,481**		
	kWh	**183,303,046**	**177,929,729**	**185,198,705**	**192,111,255**	**178,353,238**	**14,610**	**14,741**
	kW	**227,721**	**222,824**	**232,795**	**233,941**	**219,941**	**183,202,754**	**182,877,727**

3.1.4 LOAD FORECAST METHODOLOGY AND DETAIL

The load forecast presented in this application uses the same approach as used in ORPC's most recent Cost of Service applications (EB-2015-0105).

ORPC's load forecast is prepared in two phases:

- The first phase, a billed energy forecast by customer class for 2022, is developed using a total purchase (**Wholesale**) basis regression analysis.
- Then, in the second phase, usage associated with the known change in customers for 2022 is determined and added or removed (if applicable) (**Adjusted Wholesale**).

The methodology proposed in this application predicts wholesale consumption (**Predicted**) using a multiple regression analysis that relates historical monthly wholesale kWh usage (normally January 2011 to December 2020 however 2014-2020 were used in this case) to carefully selected variables. The one-way analysis of variance (**ANOVA**) is used to determine whether there are any statistically significant differences between the means of three or more independent (unrelated) groups. The ANOVA compares the means between the groups you are interested in and determines whether any of those means are statistically significantly different from each other.

ORPC did not test the Normalized Average Consumption (NAC) method because NAC is generally seen as an alternative when reliable historical data is not available.

The most significant variables used in weather related regressions are monthly historical heating degree days and cooling degree days. Heating degree-days (HDD) provide a measure of how much (in degrees), and for how long (in days), the outside temperature was below that base temperature. The most readily available heating degree days come with a base temperature of 18°C. Cooling degree-day (CDD) figures also come with a base temperature, and provide a measure of how much, and for how long, the outside temperature was above that base temperature.

For degree days, daily observations as reported at Environment Canada's weather station at Ottawa Airport is used because this is the closest weather-station to ORPC with reliable historic weather data.

The regression model also uses other variables which are tested to see their relationship and contribution to the fluctuating wholesale purchases. Each variable is discussed in detail later in this section.

3.1.5 ECONOMIC OVERVIEW

Location and Service Areas

ORPC services 4 distinct service areas: the City of Pembroke and the towns of Almonte, Beachburg and Killaloe. Pembroke is located 145 kms northwest of Ottawa and 214 kms southeast of North Bay whereas Almonte is located 46 kms southwest of Ottawa. Beachburg and Killaloe are located 24 kms southeast and 60 kms southwest of Pembroke respectively. Pembroke, Beachburg and Killaloe are located in Renfrew County whereas Almonte is a ward of the town of Mississippi Mills. ORPC currently services approximately 11,500 customers of which 64% are located in Pembroke, 29% in Almonte, 4% in Beachburg and 3% in Killaloe. Overall, ORPC services 35 sq. kms of urban area.

Employment

The primary employers and economic drivers in Pembroke and area are Canadian Nuclear Laboratories which employ approximately 3,000 from the region and the military base in nearby Petawawa which employs more than 6,000.[1] Unemployment in the area currently sits around 8%. The primary economic driver of Beachburg and Killaloe is tourism and recreation. Almonte has been seeing growth due to its proximity to Ottawa and the ability for citizens to commute.

Climate

Situated on the Ottawa River, Pembroke sits at an average elevation of 127m. Summers are typically long and cloudy while winters bring frost, snow and more cloud. Summers have an average temperature of 20.7 ^{0}C with winters are averaging -10.2 ^{0}C rendering the utility a summer peaking utility in recent years. The average yearly snowfall for Pembroke is 211.3 cms. Almonte shares very similar characteristics with Pembroke, Beachburg and Killaloe.

[1] The City of Pembroke, *Investment Profile Pembroke*, Investment Profile Feb 2020-web2 (pembroke.ca)

Growth

Almonte has been experiencing growth since 1999 with the town seeing an increase in the number of customers from 1,837 in 1999 to 3,314 in 2021. This represents an increase of 80% in that time frame. The growth has been mainly driven by the town's proximity to and increasing housing prices within Ottawa.

Additional subdivisions are beginning construction in both Almonte and Pembroke which include Orchardview and Carss Street in Almonte and Golfview, Blakely Crescent and Boundary Road West subdivisions in Pembroke. Little to no growth is anticipated in Beachburg or Killaloe.

3.1.6 OVERVIEW OF WHOLESALE PURCHASES

ORPC purchases electricity from Hydro One and Brookfield as well as embedded generation (FIT and MicroFIT). The following table summarizes the annual wholesale purchases for the 7-year period which ORPC has used to create its Load Forecast for the Bridge Year (2021) and Test Year (2022):

Table 3 - Wholesale Purchases (kWh) 2014-2020

Wholesale	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**AVG**
January	20,000,993	21,169,013	18,777,271	18,022,587	20,404,495	20,436,389	18,899,306	19,672,865
February	19,226,109	19,674,787	18,020,235	16,020,293	16,526,093	17,556,826	17,549,676	17,796,288
March	17,456,700	17,918,947	16,547,274	17,528,307	16,711,790	17,503,897	16,419,428	17,155,192
April	15,348,468	14,694,600	14,489,292	13,857,420	14,958,390	14,640,514	13,894,510	14,554,742
May	14,153,569	13,446,687	13,609,041	13,454,130	13,429,315	13,311,114	13,635,457	13,577,045
June	15,797,161	13,517,818	14,339,192	13,679,982	13,794,713	13,318,967	14,359,977	14,115,402
July	14,657,239	15,502,230	15,631,801	14,921,619	17,209,927	17,153,264	17,990,168	16,152,321
August	14,519,949	14,963,674	16,274,410	13,912,077	16,486,570	14,842,729	15,013,728	15,144,734
September	11,739,127	14,378,950	13,512,285	14,159,111	14,085,299	12,965,879	12,869,208	13,387,123
October	14,153,187	14,521,149	14,356,792	13,514,543	13,706,313	13,942,630	13,977,501	14,024,588
November	16,001,154	14,184,881	16,182,465	15,746,453	16,998,621	16,667,058	15,001,741	15,826,053
December	18,583,492	16,492,590	18,458,395	19,365,329	18,482,963	18,577,098	17,976,518	18,276,626
Total	**191,637,148**	**190,465,329**	**190,198,454**	**184,181,851**	**192,794,491**	**190,916,363**	**187,587,218**	**189,682,979**

From 2014 to 2016, ORPC's load saw small decreases with a significant decrease in 2017 mainly due to warm winter temperatures. For 2018 to 2019, temperatures increased to normal levels while 2020 saw a slight decrease also due to warm winter weather. Overall, ORPC's load decreased by 2.11% when comparing 2014 Wholesale Purchases to 2020 (191,637,148 kWh in 2014 compared to 187,587,218 kWh in 2020). Although ORPC has experienced customer growth of less than 1% per year, the LDC has observed a decrease in the average monthly kWh consumed per customer. This kWh usage per customer decrease could be attributed to energy-saving initiatives (e.g. replacing bulbs with LED lights) as well as larger customers partaking in energy conservation programs to reduce their electricity peak demand as well as energy costs.

In preparing its load forecast, ORPC used the invoices from the supply facilities to collect the monthly Wholesale kWh purchases data by:

- Collecting the monthly data from 2016 to 2020 for each energy provider or generator through the invoices received;

- Verifying the usage on the invoices received through ORPC's internal metering software; and
- Documenting and totalling the monthly kWh purchases into an Excel by energy provider or generator which are composed of the following:
    - Hydro One, composed of:
        - Cobden TS
        - Pembroke TS
        - Almonte TS
    - Mississippi River Power Corporation
    - Enerdu Power Systems
    - Brookfield Renewable Trading & Marketing; and
    - Microfits.

The Hydro One kWh purchases were required to be modified to represent the unadjusted figures. A report attached in Appendix A has been provided to outline the calculation method for 2020 to arrive at the unadjusted kWhs purchased. This report was prepared by Metsco Energy Solutions Inc. by ORPC request following the identification of abnormal line loss percentages. The differences arise from a complex structure with Hydro One that includes 11 metering points and legacy embedded generation from a generator in ORPC's service territory that generates excess generation into the Hydro One grid. The data identified as the true unadjusted purchases does not directly appear on the Hydro One invoices and details received on each billing.

Following receipt of the report, ORPC followed the methodology in the report to revise its 2016 to 2019 usage data.

The table below illustrates monthly Wholesale purchases from its suppliers using the above method and compares the annual totals to the quantities as filed under RRR 2.1.5 Supply & Delivery:

Table 4 – Wholesale as filed vs RRR 2.1.5

Reporting Year	RRR 2.1.5 Supply (kWh)	Revised Supply per Appendix A Methodology (kWh)	Difference (kWh)
2016	190,743,906	188,885,647	1,858,259
2017	185,695,204	185,970,179	(274,975)
2018	193,629,869	191,593,304	2,036,565
2019	192,262,140	190,200,950	2,061,190
2020	186,713,676	186,713,676	-

Wholesale Market Participants and Embedded Generation:

ORPC has no (0) Wholesale Market Participant (WMP) customers so there were no wholesale adjustments required. ORPC confirms that its wholesale includes Fit/MicroFit embedded generation.

The actual Fit/MicroFit embedded generation is shown in the table below.

Table 5 – Fit/MicroFit Embedded Generation

	2016	*2017*	*2018*	*2019*	*2020*
	microFit	**microFit**	**microFit**	**microFit**	**microFit**
Month	**Total KWH**	**Total KWH**	**Total KWH**	**Total KWH**	**Total KWH**
1	7,754.00	7,793.00	10,942.00	8,088.00	6,174.00
2	13,390.00	12,715.00	13,791.00	10,451.00	14,734.00
3	31,386.00	37,054.00	39,013.00	30,690.00	31,204.00
4	47,979.00	36,471.00	38,652.00	37,088.00	42,604.00
5	50,799.00	39,231.00	50,092.00	40,549.00	52,151.00
6	52,301.00	47,168.00	49,917.00	48,727.00	48,564.00
7	47,753.00	53,139.00	54,482.00	57,974.00	50,036.00
8	44,346.00	51,783.00	45,026.00	50,836.00	40,168.00
9	39,465.00	44,196.00	36,846.00	35,151.00	35,438.00
10	25,164.00	29,290.00	23,695.00	25,000.00	22,775.00
11	16,437.00	13,961.00	6,416.00	13,056.00	15,399.00
12	7,152.00	6,991.00	8,829.00	7,376.00	9,033.00
Total	**383,926.00**	**379,792.00**	**377,701.00**	**364,986.00**	**368,280.00**

3.1.7 OVERVIEW OF VARIABLES USED

For ORPC, the variation in monthly electricity consumption is influenced by 4 factors:

1) Weather (e.g. heating and cooling), which is by far the most dominant effect on most systems;
2) Number of days per month;
3) Conservation and Demand Management (CDM) – energy saving programs and initiatives have influenced consumers' and businesses' behaviour and usage patterns; and
4) Spring Fall Flag

Details relating to each variable used in the regression analysis are presented in the next section.

Heating and Cooling:

To determine the relationship between observed weather and energy consumption, monthly weather observations describing the extent of heating or cooling required within the month are necessary. Environment Canada publishes monthly observations on heating degree days (HDD) and cooling degree days (CDD) for selected weather stations across Canada. Heating degree-days for a given day are the number of Celsius degrees that the mean temperature is below 18°C. Cooling degree-days for a given day are the number of Celsius degrees that the mean temperature is above 18°C. For ORPC, the monthly HDD and CDD as reported at Ottawa International Airport were used because this is the closest weather-station to the utility with reliable historic weather data.

ORPC has adopted the 7-year average from 2014 to 2020 as the definition of weather normal. The LDC's opinion is that a ten-year average based on the most recent ten calendar years available is a reasonable compromise that likely reflects the "average" weather experienced in recent years.

The following table outlines the monthly weather data used in the regression analysis.

Table 6 - HDD and CDD as reported at Utility Location

HDD	***2014***	***2015***	***2016***	***2017***	***2018***	***2019***	***2020***	***AVG***
January	918.30	894.30	711.00	732.50	881.50	934.90	755.60	832.59
February	793.20	957.40	673.00	662.10	644.60	762.20	725.90	745.49
March	783.60	726.40	504.00	731.70	591.00	666.10	561.70	652.07
April	384.20	345.20	351.00	319.40	454.40	398.80	391.10	377.73
May	127.30	90.90	107.00	190.40	110.40	213.20	193.30	147.50
June	20.30	40.30	31.00	52.10	39.00	52.70	44.70	40.01
July	7.70	7.70	6.00	4.80	0.00	0.00	0.00	3.74
August	21.40	7.20	4.00	26.90	3.60	6.30	25.50	13.56
September	110.30	46.30	48.00	69.80	96.80	104.00	129.00	86.31
October	257.90	311.40	217.00	192.80	359.10	286.80	327.40	278.91
November	510.60	417.50	371.00	524.50	599.50	590.60	429.90	491.94
December	696.40	490.10	638.00	871.30	766.60	717.20	647.00	689.51
CDD	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**AVG**
January	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
February	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
March	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
April	0.00	0.00	4.00	1.20	0.00	0.00	0.00	0.74
May	8.80	23.50	84.00	9.10	15.70	0.00	25.70	23.83
June	54.90	22.50	135.00	45.00	36.20	32.00	70.40	56.57
July	62.80	103.80	198.00	63.80	156.90	133.10	185.80	129.17
August	55.80	71.20	213.00	51.00	115.40	54.80	70.40	90.23
September	21.60	51.70	88.00	52.00	49.50	9.10	9.00	40.13
October	3.10	0.00	14.00	0.40	0.70	0.00	0.00	2.60
November	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
December	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Days per month & Spring Fall Flag:

ORPC also tested a "Days per month" and "Spring and Fall Flag" variables because this identifies seasonal peaks and accounts for the more / less energy depending on the number of days in the month. The days per month did not yield particularly significant results, it did improve the R-Square, and therefore ORPC opted to keep it as a variable. The Spring and Fall flag on the other hand yielded significant R-Square therefore OPRC opted to keep the variable in its regression.

Multiple Regression Analysis:

Using a combination of adjusted Wholesale kWh purchases and the variables listed above, a multiple regression analysis was used to develop an equation describing the relationship between monthly actual wholesale kWh and the explanatory variables. ORPC also used a correlation function to examine the relationship between the variables included in the analysis. The results of the correlation analysis for each scenario can also be found at worksheet "Output" of the Load Forecast model.

To project the adjusted wholesale purchases for the 2021 Bridge Year and 2022 Test Year, the model uses the following mathematical conventions:

Table 7 – Treatment of Variables in Bridge Year & Test Year

Variable	Convention Applied to 2021 Bridge and 2022 Test Years
a) Heating and Cooling:	Used 7-year monthly average of 2014 to 2020 and applied to both 2021 and 2022. Stats Canada (*Environment Canada's weather station at Ottawa International Airport.*)
b) Number of days per month:	Used actuals for both 2021 and 2022. This variable was computed by the utility.
c) Spring and Fall Flag	Used actuals for both 2021 and 2022. This variable was computed by the utility.

Rationale for including and excluding variables:

During the process of testing the regression analysis, many different variables and time periods are tested to arrive at the best R-Squared. The utility's rationale behind selecting or dropping certain variables involves a "no-worse" rationale. In other words, if a variable is justified and does not worsen the R-Squared results, it is generally kept as one of the regression variables.

3.1.8 REGRESSION RESULTS

The table below represents the regression results used to determine ORPC's Load Forecast:

Table 8 - Correlation/Regression Results

Equation Parameters			95% Confidence/Autocorrelation	
R Squared	0.9032	89.83% of the change in WS can be explained by	1.619	Durbin-Watson Statistic
Adjusted R Squared	0.8983	the change in the 4 independent variables	1.56 - 1.72	Positive autocorrelation maybe present
Standard Error	681002.8750	to +/- on result of Regression Equation	2.482	Critical F-Statistic - 95% Confidence
F - Statistic	184.3674	Therefore analysis IS Significant	86.11%	Confidence to which analysis holds

Multiple Regression Equation					Independent Analysis			Auto Correlation	Multicol
	Coefficients	Standard Error	t Stat	p Value	R Squared	Coefficient	Intercept	Dl=1.61 Du=1.66 DW-Stat	Adjusted R-Squared against other Indep
Intercept	1,974,589.627	2,885,823.682	0.684	49.58%					
HDD	7,366.220	353.485	20.839	0.00%	60.72%	5432.38	13833433.00	0.33	50.57%
CDD	18,467.788	2,388.677	7.731	0.00%	1.72%	-5712.51	15970327.00	0.66	57.77%
Days in month	368,039.759	95,191.505	3.866	0.02%	0.01%	22875.11	15110586.00	2.99	2.93%
Spring/Fall	-1,150,553.019	178,141.511	-6.459	0.00%	24.59%	-2105582.21	16859706.00	1.35	27.80%

The resulting regression equation yields an adjusted R-squared of 0.8983. When actual annual Wholesale kWh Purchases values are compared to annual Wholesale kWh Predicted values resulting from the regression equation, the mean absolute percentage error (MAPE) is 0.099%.

Once ORPC calculated its' preferred Regression Results, the Load Forecast model then uses the coefficients from the regression results to adjust the Wholesale purchases. The table below demonstrates the results of this adjustment and compares the actual Wholesale purchases to the predicted Wholesale purchases.

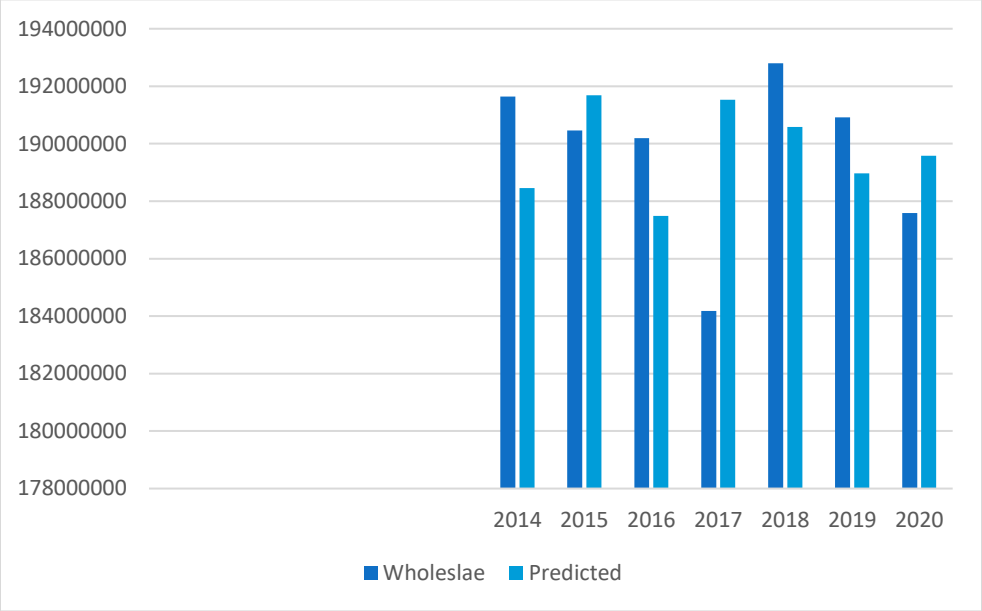
Table 9 - Wholesale vs. Adjusted Purchases (Predicted) using the Coefficients from the Regression Results

kWh Purchased VS Weather Adjusted

Year	Wholesale	year over year	Predicted	year over year	Wholesale vs Predicted	
2014	191,637,148		188,460,831		-1.66%	1.66%
2015	190,465,326	-0.61%	191,686,295	1.71%	0.64%	0.64%
2016	190,198,453	-0.14%	187,486,875	-2.19%	-1.43%	1.43%
2017	184,181,851	-3.16%	191,531,130	2.16%	3.99%	3.99%
2018	192,794,489	4.68%	190,586,281	-0.49%	-1.15%	1.15%
2019	190,916,365	-0.97%	188,965,897	-0.85%	-1.02%	1.02%
2020	187,587,218	-1.74%	189,972,510	0.53%	1.27%	1.27%
					Mean	**1.65%**
					Median	**1.29%**

The graph below illustrates variances between Actual Wholesale kWh Purchase kWh versus Adjusted Wholesale kWh Purchases and indicates the resulting prediction equation to be reasonable:

Table 10 – Actual Wholesale kWh Purchases vs. Forecasted kWh



The table below presents the results of the mean absolute deviation (MAD), the mean square error (MSE), the root mean square (RMSE) and the mean absolute percentage error (MAPE):

Table 11 - MAP-MSE-MAPE Results

Period	***Actual***	***Forecast***	***Error***	***Absolute Value of Error***	***Square of Error***	***Absolute Values of Errors Divided by Actual Values.***
t	A_t	F_t	$A_t - F_t$	$\lvert A_t - F_t \rvert$	$(A_t - F_t)^2$	$\lvert (A_t - F_t)/A_t \rvert$
5	191,637,148	188,460,831	3,176,317	3,176,317	10,088,990,429,890	0.0166
6	190,465,329	191,686,295	-1,220,966	1,220,966	1,490,758,010,193	0.0064
7	190,198,454	187,486,875	2,711,579	2,711,579	7,352,661,811,263	0.0143
8	184,181,851	191,531,130	-7,349,279	7,349,279	54,011,902,678,959	0.0399
9	192,794,491	190,586,281	2,208,210	2,208,210	4,876,190,531,234	0.0115
10	190,916,363	188,965,897	1,950,466	1,950,466	3,804,319,353,279	0.0102
	Totals		**1476327.501**	**18616817.648**	**81624822814818.200**	**0.099**

The mean absolute deviation (MAD) is the sum of absolute differences between the actual purchases and the forecast purchases divided by the number of observations.

Mean square error (MSE) is probably the most used error metric. It penalizes larger errors because squaring larger numbers has a greater impact than squaring smaller numbers. The MSE is the sum of the squared errors divided by the number of observations.

Mean Absolute Percentage Error (MAPE) is the average of absolute errors divided by actual observation value

3.1.9 DETERMINATION OF LOAD FORECAST

This section presents the load forecast by customer rate class.

ORPC has included the **historical 7-year** data to determine the forecast for the **weather-sensitive rate** classes, namely Residential, GS< 50kW and GS 50-4999kW class.

1) Allocation to specific weather sensitive rate classes (Residential, GS<50, GS>50) is based on the share (%) of each classes' actual retail kWh (exclusive of distribution losses) and a share of actual wholesale kWh.
2) Weather normalized wholesale kWh, for historical years, are allocated to these classes based on these historical shares. Forecast values for 2022 are allocated based on an average of the last 7 years.
3) For those rate classes that use kW consumption as a billing determinant, sales for these customer classes are then converted to kW based on the historical volumetric relationship between kWh and kW. The utility then forecasts a consumption per customer and adds new customer's load to the total consumption for the class. For non-weather sensitive classes, ORPC used a 3-year historical average.

   Allocation to specific **non-weather sensitive** rate classes (GS>50, USL, Sentinel and Streetlights) is based on an average of **3-years** of demand/customer which is a more appropriate historical average to determine the demand per customer. The LDC chose the 3-year average because this reflects reduced kW demand due to CDM programs delivered and implemented during this period. This average is then applied to the customer count for the bridge and test year.

Explanations for material changes in the definition of or major changes over time, explanations of the bridge and test year forecasts by rate class, variance analysis between the last OEB-approved and the actual and weather-normalized actual results are presented at Section 3.3.1 Variance Analysis of Load Forecast.

3.1.9.1 WEATHER SENSITIVE CLASSES

Table 12 – Residential Forecast (Weather Sensitive)

Year	Residential Actual kWh	Total Actual Wholesale	Ratio%	Predicted Wholesale	Residential Weather Normal	Per customer
2014	79,483,998	191,637,148	41.48%	189,063,542	78,416,562	8,437
2015	77,615,395	190,465,326	40.75%	188,460,831	76,798,555	8,176
2016	76,635,115	190,198,453	40.29%	191,686,295	77,234,599	8,125
2017	76,119,517	184,181,851	41.33%	187,486,875	77,485,432	8,071
2018	81,716,499	192,794,489	42.39%	191,531,130	81,181,021	8,236
2019	85,932,903	190,916,365	45.01%	190,586,281	85,784,330	8,614
2020	85,141,857	187,587,218	45.39%	188,965,897	85,767,610	8,513
2021			42.38%	189,972,510	80,502,554	7,991
2022			42.38%	189,627,160	80,356,209	7,885

Table 13 – General Service<50 kW Forecast (Weather Sensitive)

Year	Actual kWh	Total Wholesale	Ratio%	Predicted Wholesale	Weather Normal	Per customer
2014	31,649,726	191,637,148	16.52%	189,063,542	31,224,684	23,719
2015	30,536,533	190,465,326	16.03%	188,460,831	30,215,160	23,083
2016	29,514,061	190,198,453	15.52%	191,686,295	29,744,937	23,013
2017	28,872,534	184,181,851	15.68%	187,486,875	29,390,633	22,926
2018	30,060,062	192,794,489	15.59%	191,531,130	29,863,082	23,196
2019	30,767,208	190,916,365	16.12%	190,586,281	30,714,013	23,888
2020	26,233,400	187,587,218	13.98%	188,965,897	26,426,203	20,695
2021			15.63%	189,972,510	29,699,107	23,377
2022		*Avg*	15.63%	189,627,160	29,645,117	23,453

Table 14 – General Service 50-4,999 kW Forecast (Weather Sensitive)

Year	Actual kWh	Total Wholesale	Ratio%	Predicted Wholesale	Weather Normal	Per customer
2014	72,512,849	191,637,148	37.84%	189,063,542	71,539,032	490,553
2015	68,528,024	190,465,329	35.98%	188,460,831	67,806,821	455,844
2016	75,048,053	190,198,454	39.46%	191,686,295	75,635,122	505,076
2017	70,829,349	184,181,851	38.46%	187,486,875	72,100,336	476,696
2018	71,502,339	192,794,491	37.09%	191,531,130	71,033,792	442,119
2019	73,532,152	190,916,363	38.52%	190,586,281	73,405,019	491,551
2020	65,161,090	187,587,218	34.74%	188,965,897	65,639,994	438,575
2021			37.44%	189,577,824	70,975,495	472,178
2022		*Avg*	37.44%	189,577,824	70,975,495	470,140

3.1.9.2 NON-WEATHER SENSITIVE CLASSES

ORPC has adopted the average analysis approach to provide a forecast of kW demand for the applicable rate classes as shown in the table below:

Table 15 – Unmetered Scattered Load Forecast

Year	kWh	Connection	kWh per connection
2014	454,406	20	22,720
2015	567,489	20	28,374
2016	594,265	19	31,277
2017	606,898	19	31,942
2018	605,298	19	31,858
2019	613,238	19	32,276
2020	602,100	19	31,689
2021	606,879	19	31,941
2022	606,879	19	31,941
Avg			*31,941*

Table 16 – Sentinel Lighting Forecast

Year	kWh	kW	Customer	kWh per customer	KW per customer	KW/kWh Ratio
2014	245,570	684	185	1,327	3.6973	0.00279
2015	240,165	52	183	1,312	0.2842	0.00022
2016	217,806	629	182	1,195	3.4513	0.00289
2017	203,681	546	178	1,144	3.0674	0.00268
2018	203,849	529	178	1,145	2.9719	0.00260
2019	211,785	517	175	1,210	2.9543	0.00244
2020	199,124	516	171	1,164	3.0175	0.00259
2021	198,287	504	169	1,173	2.9812	0.00254
2022	194,767	495	166	1,173	2.9812	0.00254
Avg			*175*	*1,173*	*2.9812*	*0.00254*

Table 17 – Street Lighting Forecast

Year	kWh	kW	Connection	kWh per connection	KW per connection	KW/kWh Ratio
2014	2,439,792	6,770	2796	873	2.4216	0.00277
2015	2,204,458	7,086	2799	788	2.5321	0.00321
2016	1,307,703	3,918	2822	463	1.3888	0.00300
2017	1,297,582	3,609	2840	457	1.2706	0.00278
2018	1,110,658	3,152	2878	386	1.0954	0.00284
2019	1,053,969	2,923	2897	364	1.0090	0.00277
2020	1,015,667	2,832	2905	350	0.9749	0.00279
2021	1,072,667	3,004	2,927	366	1.0264	0.00280
2022	1,080,789	3,027	2,949	366	1.0264	0.00280
				366	*1.02641*	*0.00280*

Adjustment to Wholesale Forecast due to LED Streetlight Conversion

In ORPC's service areas, the utility maintains and is the hydro provider for urban streetlights on behalf of the City of Pembroke, Almonte, Beachurg and Killaloe.

In 2015 and 2016, the City of Pembroke converted the streetlights to light-emitting diodes (LEDs). This conversion resulted in 1,760 lights being converted. As noted in the table above, this caused a decrease of 41% in usage from 2015 to 2016 with an overall decrease of 58% from 2014 to 2020. The project began in December 2015 and was completed in early 2016.

3.1.10 DETERMINATION OF CUSTOMER FORECAST

ORPC has used a simple geometric mean function to determine the forecasted number of customers / connections for 2021 and 2022. The geometric mean is more appropriate to use when dealing with percentages and rates of change. Although the formula is somewhat simplistic, it is reasonably representative of ORPC's natural customer growth. The geometric mean results were analyzed by the utility and then further adjusted for known particulars.

Historical yearly average number of accounts / connections and projected number of accounts / connections for 2021 and 2022 are presented in the table below. ORPC notes that to be consistent with the decision to use a 3-year average for the non-weather sensitive classes, it also opted to use a 3-year geomean to determine its customer forecast for the Sentinel, Street Lighting and USL classes. OPRC deems the results more appropriate for its 2021 and 2022 forecast.

ORPC confirms the historical numbers are the yearly average of accounts / connections represented in the table above. These yearly averages were used to derive the annual growth rate and resulting geomean rate.

Table 18 - Customer Account / Connection Forecast

	Residential		*General Service < 50 kW*		*General Service > 50 to 4999 kW*		*Sentinel*		*Street Lighting*		*USL*	
Date	**Cust/Conn**	**Growth Rate**	**Cust/Conn**	**Growth Rate**	**Cust/Conn**	**Growth Rate**	**Cust/Conn**	**Growth Rate**	**Cust/Conn**	**Growth Rate**	**Cust/Conn**	**Growth Rate**
2014	9294		1,316.42		146		185		2796		20	
2015	9394	1.0107	1,309.00	0.9944	149	1.0200	183	0.9892	2799	1.0010	20	1.0000
2016	9506	1.0120	1,292.50	0.9874	150	1.0067	182	0.9959	2822	1.0082	19	0.9500
2017	9600	1.0099	1,282.00	0.9919	151	1.0100	178	0.9767	2840	1.0066	19	1.0000
2018	9741	1.0147	1,287.42	1.0042	149	0.9868	178	1.0000	2878	1.0132	19	1.0000
2019	9857	1.0120	1,285.75	0.9987	149	1.0006	175	0.9831	2897	1.0068	19	1.0000
2020	9959	1.0103	1,276.92	0.9931	150	1.0022	171	0.9771	2905	1.0028	19	1.0000
Geomean		*1.0116*		*0.9949*		*1.0043*		*0.9867*		*1.0076*		*1.0000*
2021	10074		1,270.45		150		169		2927		19	
2022	10191		1,264.02		151		166		2949		19	

Adjustment to the Wholesale kWh Forecast for COVID-19 Pandemic

ORPC has made not made any specific adjustments to its' adjusted Wholesale kWh purchases to account for the effect of changing electricity usage as a result of the COVID-19 pandemic. The 2020 actuals which were used which for the purpose of determining the test year forecast inherently include any effects of Covid. With the Emergency Order declared by the Province of Ontario on March 17th, 2020, there have been notable changes resulting in altered behaviour patterns of electricity consumption and demand by residential and business customers. For example, business closures and an increase in the number of people working from home.

ORPC is not cognizant of the medium or long-term effects of these behavioral changes and how it may alter the utility's load forecast. Therefore, ORPC has not made any adjustments to its' adjusted Wholesale kWh purchases due to COVID-19.

3.1.11 FINAL WEATHER NORMALIZED LOAD FORECAST

The table illustrates the historic and projected weather normalized Load Forecast by customer class.

Table 19 - Final Load Forecast

	Year	2016 Actuals	2017 Actuals	2018 Actuals	2019 Actuals	2020 Actuals	2021 Predicted	2022 Predicted
Residential	Cust/Conn	9,506	9,600	9,741	9,857	9,959	10,074	10,191
	kWh	76,635,115	76,119,517	81,716,499	85,932,903	85,141,857	80,502,554	80,356,209
	kW							
General Service < 50 kW	Cust/Conn	1,293	1,282	1,287	1,286	1,277	1,270	1,264
	kWh	29,514,061	28,872,534	30,060,062	30,767,208	26,233,400	29,699,107	29,645,117
	kW							
General Service > 50 to 4999 kW	Cust/Conn	149	151	149	149	150	150	151
	kWh	75,048,053	70,829,349	71,502,339	73,532,152	65,161,090	71,123,260	70,993,966
	kW	223,174	218,669	229,114	230,501	216,593	220,207	219,807
Sentinel	Cust/Conn	182	178	178	175	171	169	166
	kWh	203,849	203,849	203,849	211,785	199,124	198,287	194,767
	kW	629	546	529	517	516	504	495
Street Lighting	Cust/Conn	2,822	2,840	2,878	2,897	2,905	2,927	2,949
	kWh	1,307,703	1,297,582	1,110,658	1,053,969	1,015,667	1,072,667	1,080,789
	kW	3,918	3,609	3,152	2,923	2,832	3,004	3,027
USL	Cust/Conn	19	19	19	19	19	19	19
	kWh	594,265	606,898	605,298	613,238	602,100	606,879	606,879
	kW	-	-	-	-	-	-	-
Total	**Cust/Conn**	**13,971**	**14,070**	**14,252**	**14,383**	**14,481**	**14,610**	**14,741**
	kWh	**183,303,046**	**177,929,729**	**185,198,705**	**192,111,255**	**178,353,238**	**183,202,754**	**182,877,727**
	kW	**227,721**	**222,824**	**232,795**	**233,941**	**219,941**	**223,715**	**223,329**

ORPC is not cognizant of the medium or long-term effects of the COVID-19 pandemic and how it may alter the utility's load forecast. Therefore, ORPC has not made any adjustments to its adjusted Wholesale kWh purchases or Load Forecast due to COVID-19.

3.2 IMPACT AND PERSISTENCE FROM HISTORICAL CDM PROGRAMS

3.2.1 LOAD FORECAST CDM ADJUSTMENT WORK FORM

ORPC assumes that its conservation efforts are embedded in its load and as a result, the Test Year load forecast needs not be adjusted for the impacts on energy purchases arising from CDM programs undertaken by ORPC's customers.

3.2.2 ALLOCATION OF CDM RESULTS

As there is no adjustment for CDM in ORPC's load forecast for the Test Year (2022), no allocation of projected CDM savings for customer rates classes is required.

3.2.3 FINAL CDM ADJUSTED LOAD FORECAST

As there is no adjustment for CDM in ORPC's load forecast for the Test Year (2022), the final weather normalized load forecast and summary of billing determinants by rates class as presented in section 3.1.12 will be used to develop ORPC's proposed rates.

3.3 ACCURACY OF LOAD FORECAST AND VARIANCE ANALYSIS

3.3.1 VARIANCE ANALYSIS OF LOAD FORECAST

Table 20 below shows the yearly change in consumption for the Residential class.

Table 20 - Residential Variance

	Residential				
Year	Cust/Conn	Cust +/-	kWh	kWh +/-	kWh/Cust
2016 Actuals	9,506		76,635,115		
2017 Actuals	9,600	94	76,119,517	-515,598	7,929
2018 Actuals	9,741	141	81,716,499	5,596,982	8,389
2019 Actuals	9,857	116	85,932,903	4,216,404	8,718
2020 Actuals	9,959	102	85,141,857	-791,046	8,549
2021 Predicted	10,074	115	80,502,554	-4,639,303	7,991
2022 Predicted	10,191	117	80,356,209	-146,345	7,885

The number of residential customers has increased from ORPC's last cost of service back in 2016 to 2020. The kWh consumption has seen both some increases and decreases over the same period, with 2018-2019 kWhs being the highest. This increase in consumption is consistent with the combined increase in customer number of 232 for the projected years.

While the number of Residential customers has increased, usage per customer has decreased which is likely to be attributable to energy conservation measures and newer homes and appliances being more energy efficient. The decrease may also be expected as workers return to the office and additional pandemic safety measures are introduced. The overall increase in usage could be attributed to higher than average summer temperatures and customer growth.

Table 21 – General Service <50 kW Variance

	General Service < 50 kW				
Year	Cust/Conn	Cust +/-	kWh	kWh +/-	kWh/Cust
2016 Actuals	1,293		29,514,061		
2017 Actuals	1,282	-11	28,872,534	-641,527	22,521
2018 Actuals	1,287	5	30,060,062	1,187,528	23,349
2019 Actuals	1,286	-2	30,767,208	707,146	23,929
2020 Actuals	1,277	-9	26,233,400	-4,533,808	20,544
2021 Predicted	1,270	-6	29,699,107	3,465,707	23,377
2022 Predicted	1,264	-6	29,645,117	-53,990	23,453

** Number of customers is expressed in year average format*
*** kWh is metered without loss*

The number of customers and consumption in the GS<50 kW have experienced a slight decline since the last Cost of Service in 2016 with the exception of 2018-2019.

The 2020 usage declined substantially from 2019 with business interruptions and closures as a result of the lockdowns caused by the beginning of the pandemic. The 2021 usage assumes a return to usage slightly below that of previous years.

The projected consumption for 2022 is 29,645,117 kWh which is on par with the 7-year average for this customer class.

Table 22 – General Service 50-4999 kW Variance

General Service > 50 to 4999 kW

Year	Cust/Conn	Cust +/-	kWh	kWh +/-	kW	kW +/-	kW/Cust
2016 Actuals	149		75,048,053		223,174		
2017 Actuals	151	2	70,829,349	-4,218,704	218,669	-4,505	1,446
2018 Actuals	149	-2	71,502,339	672,990	229,114	10,445	1,535
2019 Actuals	149	0	73,532,152	2,029,813	230,501	1,387	1,544
2020 Actuals	150	0	65,161,090	-8,371,062	216,593	-13,908	1,447
2021 Predicted	150	1	71,123,260	5,962,170	220,207	3,614	1,465
2022 Predicted	151	1	70,993,966	-129,294	219,807	-400	1,456

** Number of customers is expressed in year average format*
*** kWh is metered without loss*

Similar to the GS<50kW, the number of customers in the GS 50-999 kW class have also seen a slight decline since the last Cost of Service in 2016.

The region's GS>50 customers have remained relatively stable over the past several years with usage seeing slight increase from 2017 to 2019 which is consistent with the increases seen in residential and GS<50 customer classes. There was a significant decrease in 2020 related to the pandemic amid lockdowns which restricted operations for several customers. With challenges in most parts of rural Ontario with its' relatively narrow economic base and concentration in slow growing or declining industries, little to no growth is anticipated.

The projected consumption for 2022 is 70,993,966495 kWh and 219,807 kW which is on par with the 7-year average used to determine the test year forecast which anticipates one new customer in each of the bridge and test year.

Table 23 – Unmetered Scattered Load Variance

	USL				
Year	Cust/Conn	Cust +/-	kWh	kWh +/-	kWh/Cust
2016 Actuals	19		594,265		
2017 Actuals	19	0	606,898	12,633	31,942
2018 Actuals	19	0	605,298	-1,600	31,858
2019 Actuals	19	0	613,238	7,940	32,276
2020 Actuals	19	0	602,100	-11,138	31,689
2021 Predicted	19	0	606,879	4,779	31,941
2022 Predicted	19	0	606,879	0	31,941

** Number of connections is expressed in year average format*
*** kWh is without loss*

Connection count and consumption for the Unmetered Scattered Load class has been relatively consistent since the last Cost of Service in 2016. The Load Forecast model uses a 3-year (2018-2020) average to determine the projections.

ORPC's geomean calculations anticipate a handful of connections in in 2021 or 2022. The projected consumption for 2022 is 606,879 kWh which is consistent with past consumption with additional connections factored in.

Table 24 – Sentinel Lighting Variance

	Sentinel						
Year	Cust/Conn	Cust +/-	kWh	kWh +/-	kW	kW +/-	kWh/Cust
2016 Actuals	182		203,849		629		
2017 Actuals	178	-4	203,849	0	546	-83	3.07
2018 Actuals	178	0	203,849	0	529	-17	2.97
2019 Actuals	175	-3	211,785	7,936	517	-12	2.95
2020 Actuals	171	-4	199,124	-12,661	516	-1	3.02
	169	-2	198,287	-837	504	-12	2.99
2021 Predicted	166	-2	198,287	-837	504	-12	2.99
2022 Predicted	182		194,767	-3,520	495	-9	2.97

** Number of connections is expressed in year average format*
*** kWh is without loss*

The connection count, consumption and kWh for the Sentinel Lighting class has generally declined since the last Cost of Service in 2016. The Load Forecast model uses a 3-year (2018-2020) average to determine the projections.

ORPC's geomean calculations to forecast its connection for connections in 2021 or 2022 anticipates a loss of a dozen connections with the Load Forecast also mimicking the same pattern.

The table below illustrates the yearly change in connections, kWh consumption and kW demand for the Streetlight class:

Table 25 – Streetlight Variance

	Street Lighting						
Year	Cust/Conn	Cust +/-	kWh	kWh +/-	kW	kW +/-	kWh/Cust
2016 Actuals	2,822		1,307,703		3,918		
2017 Actuals	2,840	19	1,297,582	-10,121	3,609	-309	1.27
2018 Actuals	2,878	38	1,110,658	-186,924	3,152	-457	1.10
2019 Actuals	2,897	20	1,053,969	-56,689	2,923	-229	1.01
2020 Actuals	2,905	8	1,015,667	-38,302	2,832	-91	0.97
2021 Predicted	2,927	22	1,072,667	57,000	3,004	172	1.03
2022 Predicted	2,949	22	1,080,789	8,122	3,027	23	1.03

** Number of connections is expressed in year average format*
*** kWh is without loss*

The connection count, consumption and demand for the Streetlight class has been consistent since ORPC's last Cost of Service in 2016.

At the end of 2020, ORPC had 5 street lighting customers which combined for a total of 2,905 connections. The City of Pembroke converted 1,760 streetlights to LED lights in 2015 and 2016 and has slowly introduced additional lights with new construction projects.

The table below summarizes the variance between the 2016 Board Approved Load Forecast and the Test Year (2022) Load Forecast.

Table 26 – 2016 Board Approved VS 2022 Load Forecast

	Year	2016 Actuals	2022 Forecast	Variance
Residential	Cust/Conn	9,463	10,191	728
	kWh	76,966,389	80,356,209	3,389,820
	kW		0	0
			0	0
General Service < 50 kW	Cust/Conn	1,281	1,264	-17
	kWh	34,297,661	29,645,117	-4,652,544
	kW		0	0
			0	0
General Service > 50 to 4999 kW	Cust/Conn	148	151	3
	kWh	74,077,571	70,993,966	-3,083,605
	kW	210,853	219,807	8,954
			0	0
Sentinel	Cust/Conn	195	166	-29
	kWh	250,870	194,767	-56,103
	kW	715	495	-220
			0	0
Street Lighting	Cust/Conn	2,849	2,949	100
	kWh	1,379,313	1,080,789	-298,524
	kW	3,840	3,027	-813
			0	0
USL	Cust/Conn	20	19	-1
	kWh	464,212	606,879	142,667
	kW	0	0	0
				0
				0
Total	**Cust/Conn**	**13,956**	**14,741**	**785**
	kWh	**187,436,016**	**182,877,727**	**-4,558,289**
	kW	**215,408**	**223,329**	**7,921**

ORPC acknowledges that the utility has little control over its' Board Approved Load Forecast as the regulator dictates the manner in which the forecast is determined (i.e. using a multivariate regression analysis based on multi-year historical values.) In other words, the Load Forecasting process is formulaic in nature and hence year-over-year variances are outside of the utility's control.

The overall decrease in consumption is a result energy conservation measures from the conversion to LED street lights in municipalities to increased efficiency in appliances.

The tables below illustrate the actual average kWh consumption and kW demand per customer, by customer class, and historical and adjusted forecast average use per customer generated from the load forecast. As can be seen from the results below, the predicted use per customer follows the trend created from its historical usage per customer.

Table 27 – Residential Customer Average

Residential

Year	**Cust**	**%chg**	**kWh**	**%chg**
2014	9,294		79,483,998	#DIV/0!
2015	9,394	1%	77,615,395	-2%
2016	9,506	1%	76,635,115	-1%
2017	9,600	1%	76,119,517	-1%
2018	9,741	1%	81,716,499	7%
2019	9,857	1%	85,932,903	5%
2020	9,959	1%	85,141,857	-1%
2021	10,074	1%	80,502,554	-5%
2022	10,191	1%	80,356,209	0%

Table 28 – GS<50kW Customer Average

GS<50

Year	**Cust**	**%chg**	**kWh**	**%chg**
2014	1,316		31,649,726	
2015	1,309	-1%	30,536,533	-4%
2016	1,293	-1%	29,514,061	-3%
2017	1,282	-1%	28,872,534	-2%
2018	1,287	0%	30,060,062	4%
2019	1,286	0%	30,767,208	2%
2020	1,277	-1%	26,233,400	-15%
2021	1,270	-1%	29,699,107	13%
2022	1,264	-1%	29,645,117	0%

Table 29 – GS50-4999kW Customer Average

GS>50

Year	Cust	%chg	kWh	%chg	kW	%chg
2014	146		72,512,849		206,399	
2015	149	2%	68,528,024	-5%	212,614	3%
2016	150	1%	75,048,053	10%	223,174	5%
2017	151	1%	70,829,349	-6%	218,669	-2%
2018	149	-1%	71,502,339	1%	229,114	5%
2019	149	0%	73,532,152	3%	230,501	1%
2020	150	0%	65,161,090	-11%	216,593	-6%
2021	150	0%	71,123,260	9%	220,207	2%
2022	151	0%	70,993,966	0%	219,807	0%

Table 30 – Sentinel Customer Average

Sentinel

Year	Cust	%chg	kWh	%chg	kW	%chg
2014	185		245,570		684	
2015	183	-1%	240,165	-2%	52	-92%
2016	182	0%	217,806	-9%	629	1110%
2017	178	-2%	203,681	-6%	546	-13%
2018	178	0%	203,849	0%	529	-3%
2019	175	-2%	211,785	4%	517	-2%
2020	171	-2%	199,124	-6%	516	0%
2021	169	-1%	198,287	0%	495	-4%
2022	166	-1%	194,767	-2%	495	0%

Table 31 – Street Lighting Customer Average

Street Lighting

Year	Cust	%chg	kWh	%chg	kW	%chg
2014	2,796		2,439,793		7,086	
2015	2,799	0%	2,204,458	-10%	3,918	-45%
2016	2,822	1%	1,307,703	-41%	3,609	-8%
2017	2,840	1%	1,297,582	-1%	3,152	-13%
2018	2,878	1%	1,110,658	-14%	2,923	-7%
2019	2,897	1%	1,053,969	-5%	2,832	-3%
2020	2,905	0%	1,015,667	-4%	3,004	6%
2021	2,927	1%	1,072,667	6%	3,027	1%
2022	2,949	1%	1,080,789	1%	0	-100%

Table 32 – USL Customer Average

USL

Year	Cust	%chg	kWh	%chg
2014	20		454,406	
2015	20	0%	567,489	25%
2016	19	-5%	594,265	5%
2017	19	0%	606,898	2%
2018	19	0%	605,298	0%
2019	19	0%	613,238	1%
2020	19	0%	602,100	-2%
2021	19	0%	606,879	1%
2022	19	0%	606,879	0%

APPENDIX

LIST OF APPENDICES

Appendix 3A	2020 Distribution Line Loss Calculation Report

1 **Appendix A – 2020 Dispositions Line Loss Calculation Report**

DISTRIBUTION LINE LOSS CALCULATION

OTTAWA RIVER POWER CORPORATION

METSCO Project # P-20-146

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April 2021

DISCLAIMER

This report is prepared by METSCO Energy Solutions Inc. (METSCO) in accordance with the Terms and Conditions of METSCO proposal to Ottawa River Power Corporation (ORPC) ("the Client") for distribution line loss calculation. This study was carried out strictly for the benefit of the Client with the sole objective of meeting Ontario Energy Board (OEB) requirements.

This report is based on existing equipment and loading data obtained from the Client for their power distribution circuits. Any future modifications to the assumptions and study input data could affect the study results and the study may need to be redone at the expense of the Client.

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1. EXECUTIVE SUMMARY

Ottawa River Power Corporation (ORPC) has engaged METSCO Energy Solutions Inc. (METSCO) to conduct a loss calculation study and document the associated methodology to calculate ORPC's distribution line losses. The study was performed using ORPC's 2020 data to calculate the distribution line loss for 2020. The same methodology can be applied for past and future years. The purpose of this report is to provide a detailed explanation of the calculations that were made to complete the analysis, while providing a summary of total kWh values for each substation and a total purchased kWh and line loss percentage for the entire ORPC system for 2020.

2. ASSUMPTIONS and DATA INPUTS

METSCO was provided data in the form of multiple spreadsheets, PDF's and system schematic drawings and worked closely with ORPC to obtain clarity on the data to better understand the required line loss calculations. The most significant source of confusion was with regards to the location of the power meters in the electrical system, i.e., on the primary or secondary side of a transformer. The report that follows represents our best understanding of the ORPC electrical system as it applies to the line loss calculations. A more detailed analysis using CYME software and additional data collection to build a model of the ORPC system would provide a higher degree of accuracy in the results and can be completed upon request.

3. LOSS FACTORS

This section outlines the definitions of the different types of losses within and upstream of distributor's system.

3.1. Losses Within Distributor's System

3.1.1. "Wholesale" kWh delivered to distributor (higher value)

If directly connected to the IESO-controlled grid, kWh pertains to the virtual meter on the primary or high voltage side of the transformer at the interface with the transmission grid. This corresponds to the "With Losses" kWh value provided by the IESO's MV-WEB. It is the higher of the two values provided by MV-WEB.

If fully embedded within a host distributor, kWh pertains to the virtual meter on the primary or high voltage side of the transformer, at the interface between the host distributor and the transmission grid. For example, if the host distributor is Hydro One Networks Inc., kWh from the Hydro One Networks' invoice corresponding to "Total kWh w Losses" should be reported. This corresponds to the higher of the two kWh values provided in Hydro One Networks' invoice.

3.1.2. "Wholesale" kWh delivered to distributor (lower value)

If directly connected to the IESO-controlled grid, kWh pertains to a metering installation on the secondary or low voltage side of the transformer at the interface with the transmission grid. This corresponds to the "Without Losses" kWh value provided by the IESO's MV-WEB. It is the lower of the two kWh values provided by MV-WEB.

If fully embedded with the host distributor, kWh pertains to a metering installation on the secondary or low voltage side of the transformer at the interface between the embedded distributor and the host distributor. For example, if the host distributor is Hydro One Networks Inc., kWh from the Hydro One Networks' invoice corresponding to "Total kWh" should be reported. This corresponds to the lower of the two kWh values provided in Hydro One Networks' invoice.

Additionally, kWh pertaining to distributed generation directly connected to the distributor's own distribution network should be included in "Wholesale" kWh delivered to distributor (lower value).

3.1.3. Portion of "Wholesale" kWh delivered to distributor for its Large Use Customer(s)

If a Large Use Customer is metered on the secondary or low voltage side of the transformer, the default loss is 1%.

$$\frac{\text{Portion of "Wholesale" kWh delivered to distributor for its Large Use Customer(s)}}{\text{Portion of "Retail" kWh delivered by distributor to its Large Use Customer(s)}} = 1.01$$

3.1.4. Net "Wholesale" kWh delivered to distributor

Net "Wholesale" kWh delivered to distributor = “Wholesale" kWh delivered to distributor (lower value) – Portion of "Wholesale" kWh delivered to distributor for its Large Use Customer(s).

3.1.5. "Retail" kWh delivered by distributor

kWh corresponding to "Retail" kWh delivered by distributor should equal metered or estimated kWh at the customer’s delivery point.

3.1.6. Net "Retail" kWh delivered by distributor

Net "Retail" kWh delivered by distributor = "Retail" kWh delivered by distributor - Portion of "Retail" kWh delivered by distributor to its Large Use Customer(s).

3.1.7. Loss Factor in Distributor's system

This loss factor pertains to secondary-metered customers with demand less than 5,000 kW.

$$\text{Loss Factor in Distributor's system} = \frac{\text{Net "Wholesale" kWh delivered to distributor}}{\text{Net "Retail" kWh delivered by distributor}}$$

$$= \frac{\text{“Wholesale" kWh delivered to distributor (lower value) – Portion of "Wholesale" kWh delivered to distributor for its Large Use Customer(s)}}{\text{"Retail" kWh delivered by distributor – Portion of "Retail" kWh delivered by distributor to its Large Use Customer(s)}}$$

3.2. Losses Upstream of Distributor's System

3.2.1. Supply Facilities Loss Factor (SFLF)

If directly connected to the IESO-controlled grid, SFLF = 1.0045.

If fully embedded within a host distributor, SFLF = loss factor re losses in transformer at grid interface × loss factor re losses in host distributor's system. If the host distributor is Hydro One Networks Inc., SFLF = 1.0060 × 1.0278 = 1.0340. If partially embedded, SFLF should be calculated as the weighted average of above.

3.3. Total Losses

3.3.1. Total Loss Factor

The total loss factor pertains to secondary-metered customers with demand less than 5,000 kW. Total Loss Factor = Loss Factor in Distributor's system × Supply Facilities Loss Factor. Transformer (TX) Loss Adjustment (TLA = 0.01) is applied when a meter is below a customer owned TX.

- Supply Facilities Loss Factor = 1.0060 × 1.0278 = 1.0340
- Loss factor re losses in host distributor's system = 1.0278
- Loss factor re losses in transformer at grid interface = 1.006
- Loss Factor in Distributor's system = 1.01
- Total Loss Factor = 1.034 × 1.01

4. WHOLESALE kWh PURCHASED

This section calculates the wholesale kWh purchased at different ORPC stations in high voltage (HV), medium voltage (MV) and low voltage (LV) levels as defined in the Table below.

Table 4-1: Voltage Levels

HV	> 44 kV (e.g., 115 kV, 230 kV)
MV	44 kV
LV	< 44 kV (e.g., 4.16 kV, 12.5 kV)

4.1. Cobden TS

Cobden TS supplies Beachburg and Killaloe feeders as shown in Figures 4-1 and 4-2. Meters J3690219 and J3690204 are located at 12.47KV LV level to measure the delivered power from Hydro One Networks Inc., to ORPC.

Table 4-2: Cobden TS Meters.

Type	Point of Delivery	Account ID	Meter ID	Voltage (kV)	Name
Subordinate	10478295	200700622	J3690219	12.47	H1 43624621 - Beachburg PME
Subordinate	10408541	200800417	J3690204	12.47	H1 43624621 - Killaloe DS F2
Aggregate	**10777291**	**-**	**-**		**Cobden TS**

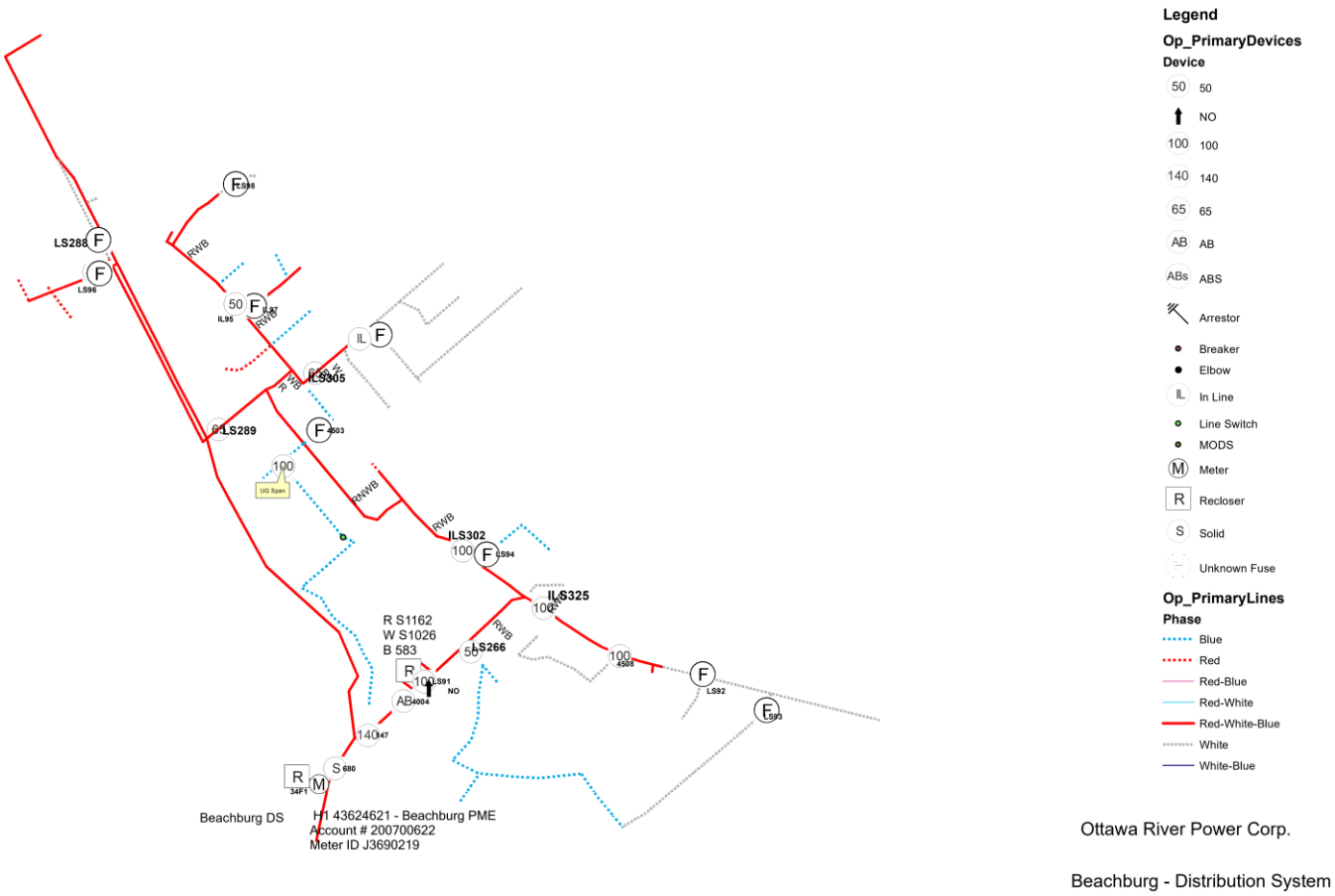

Figure 4-1: The SLD of Beachburg Feeder of Cobden TS.

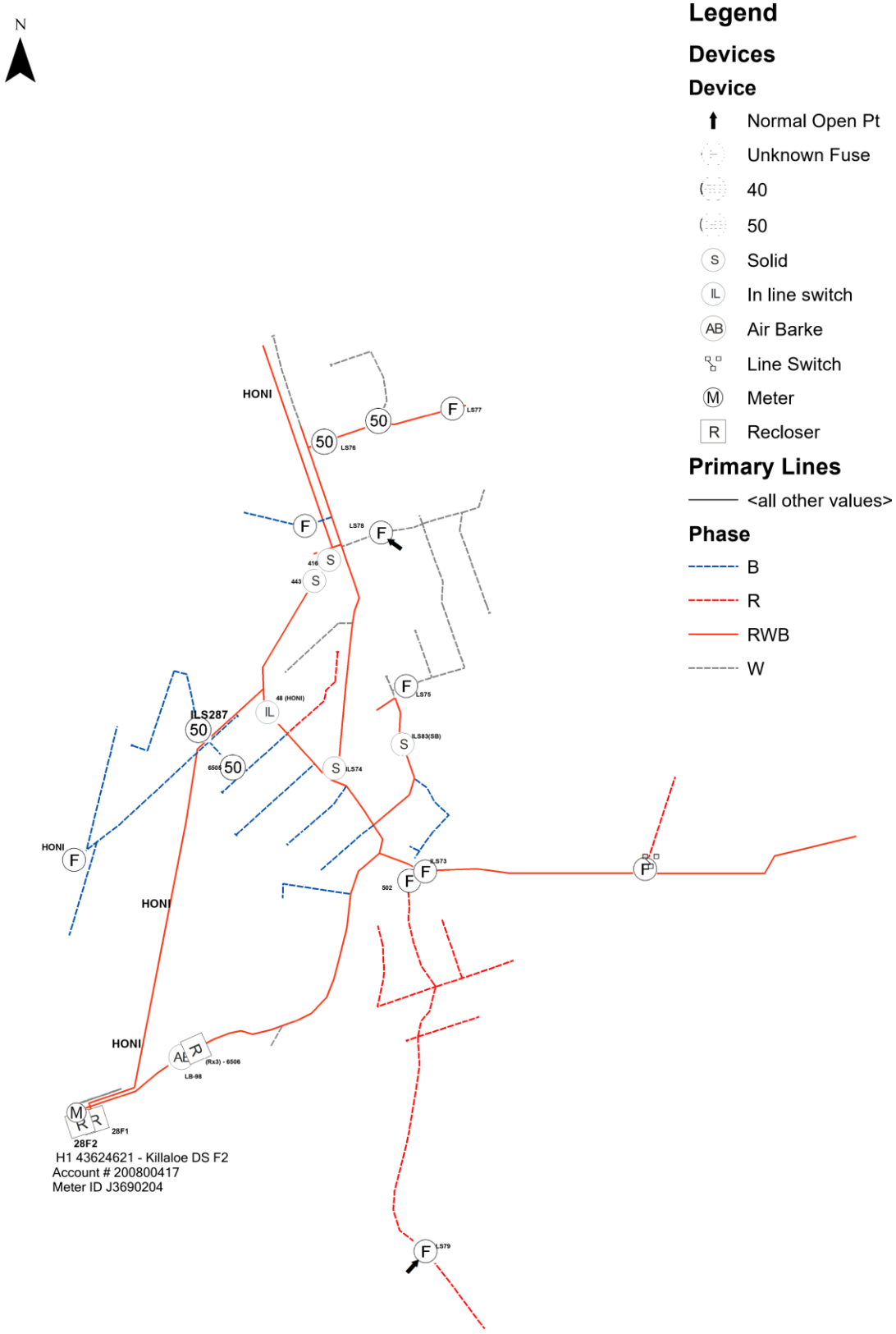

Figure 4-2: The SLD of Killaloe Feeder of Cobden TS.

Thus, the wholesale kWh purchased at different voltage levels are calculated as follows:

- Total kWh (HV) = (Beachburg PME) × (1.034) × (1.01) + (Killaloe DS F2) × (1.034) × (1.01), which includes HV/MV transformer losses, MV sub-transmission line losses, MV/LV transformer losses and LV distribution line losses.
- Total kWh (MV) = (Beachburg PME) × (1.01) + (Killaloe DS F2) × (1.01), which includes MV/LV transformer losses and LV distribution line losses.
- Total kWh (LV) = (Beachburg PME) + (Killaloe DS F2), which includes LV distribution line losses.

When Hydro One Networks Inc. is delivering power to ORPC, Total kWh (HV) > Total kWh (MV) > Total kWh (LV). When Hydro One Networks Inc. is receiving power from ORPC, Total kWh (LV) > Total kWh (MV) > Total kWh (HV).

Table 4-3: 2020 Wholesale kWh Purchased at Cobden TS.

Month	Total kWh (HV)	Total kWh (MV)	Total kWh (LV)
1	1394047.53	1348208.44	1334859.842
2	1290488.06	1248054.21	1235697.238
3	1195172.06	1155872.4	1144428.119
4	1002373.532	969413.47	959815.3168
5	894999.4215	865570.04	857000.0396
6	863633.2545	835235.26	826965.604
7	1065399.366	1030366.89	1020165.238
8	881343.7161	852363.36	843924.1188
9	780948.5953	755269.44	747791.5248
10	949854.5923	918621.46	909526.198
11	1027275.402	993496.52	983659.9208
12	1328426.67	1284745.33	1272025.079
Total	**12673962.2**	**12257216.82**	**12135858.24**

4.2. Pembroke TS

Pembroke TS supplies lines 6M1 and 6M2 as shown in Figures 4-3, 4-4, and 4-5. Meters PHON001824 and PHON002088 are located at 44KV MV level to measure the delivered power from Hydro One Networks Inc., to ORPC. Meters J3690203, J3741650, J3690316, and J3694324 are located at LV level to measure the delivered power from ORPC to Pembroke DS T1, Wal Mart, Greenwood DS T1, and 1600 Greenwood INC. Also, meter J073472 is located at 44KV MV level to measure the delivered power from ORPC to Roseburg Forest Products Canada Ltd.

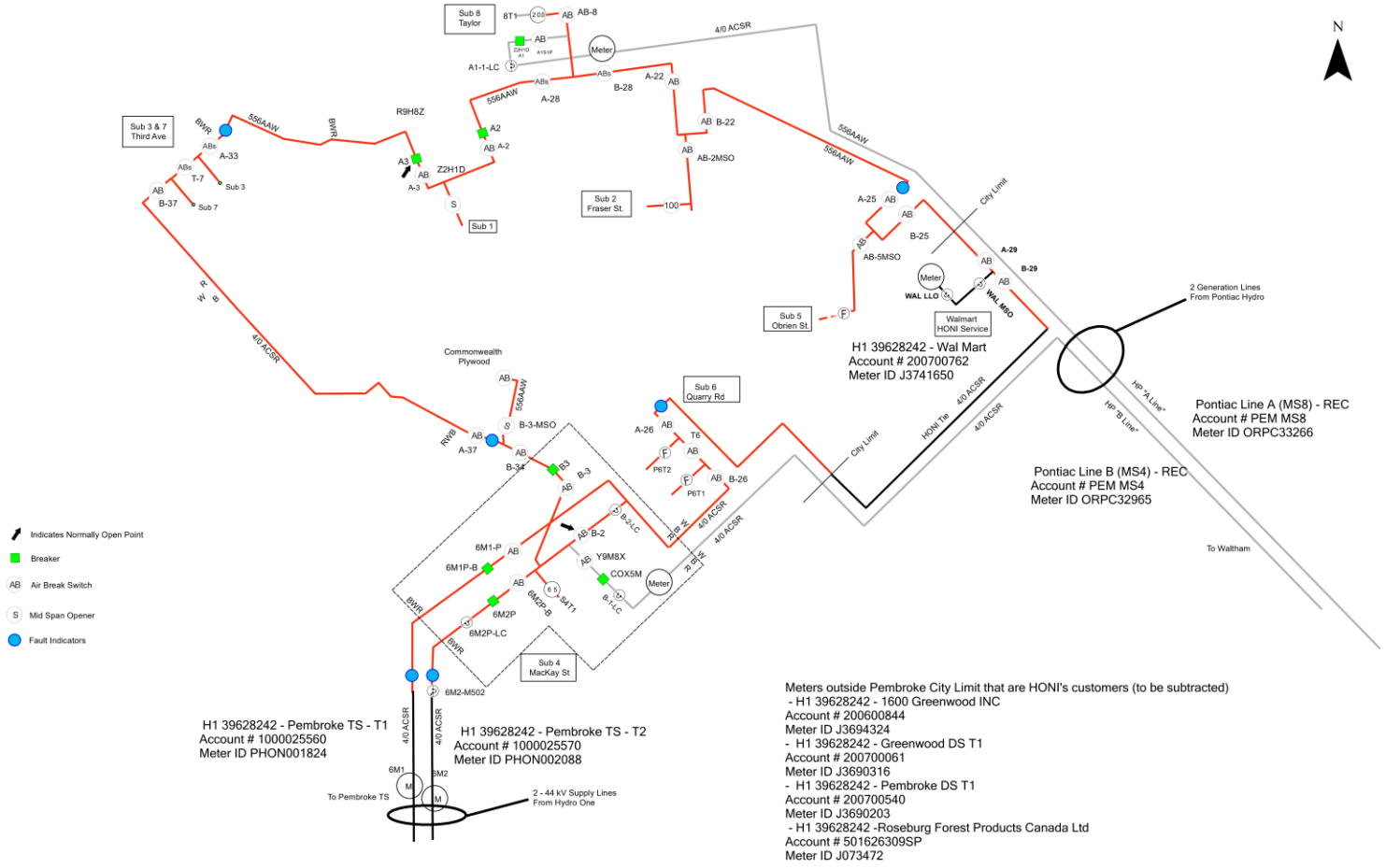

Figure 4-3: The SLD of Pembroke TS.

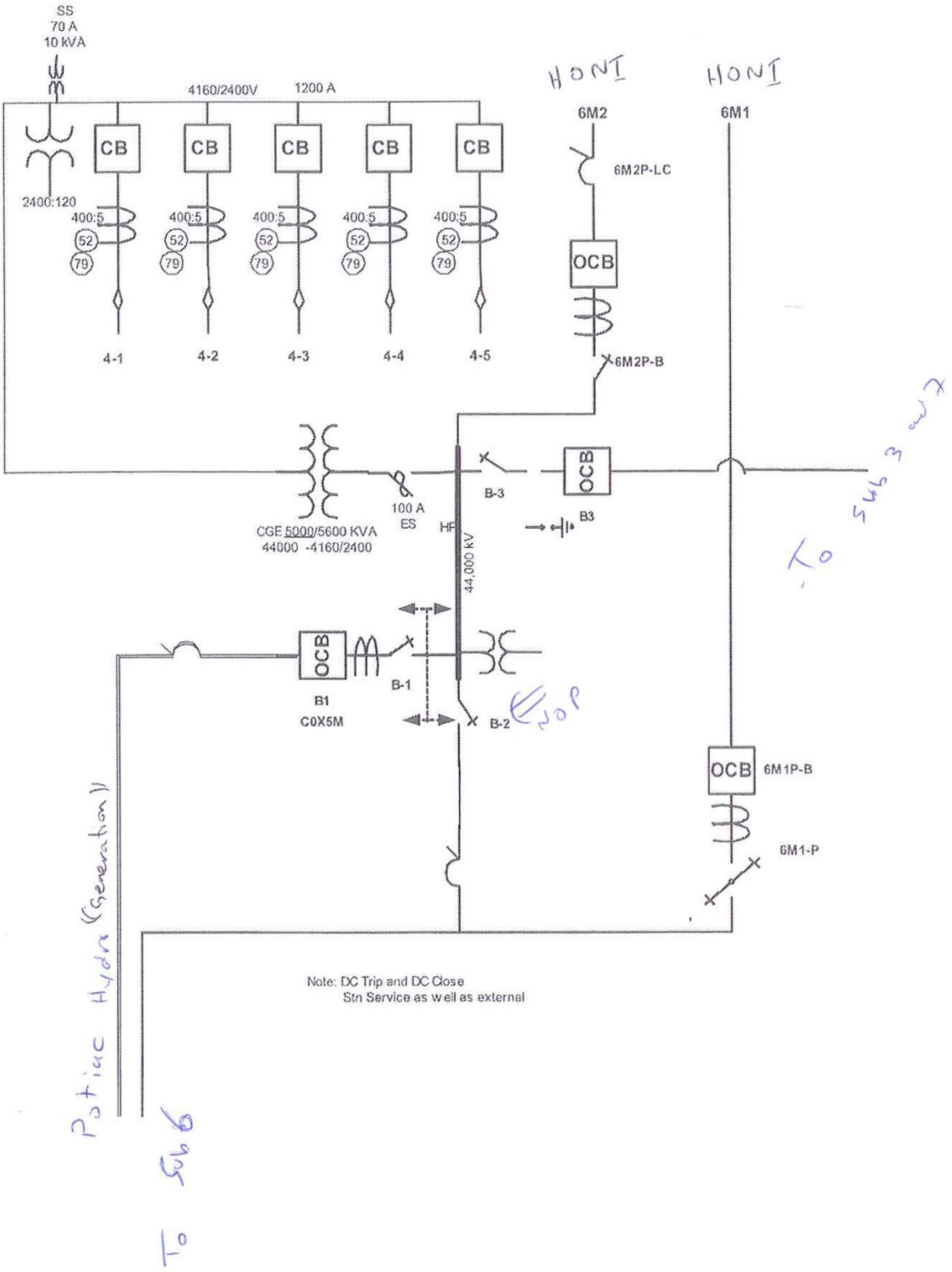

Figure 4-4: The SLD of Substation 4-Mackey Street of Pembroke TS.

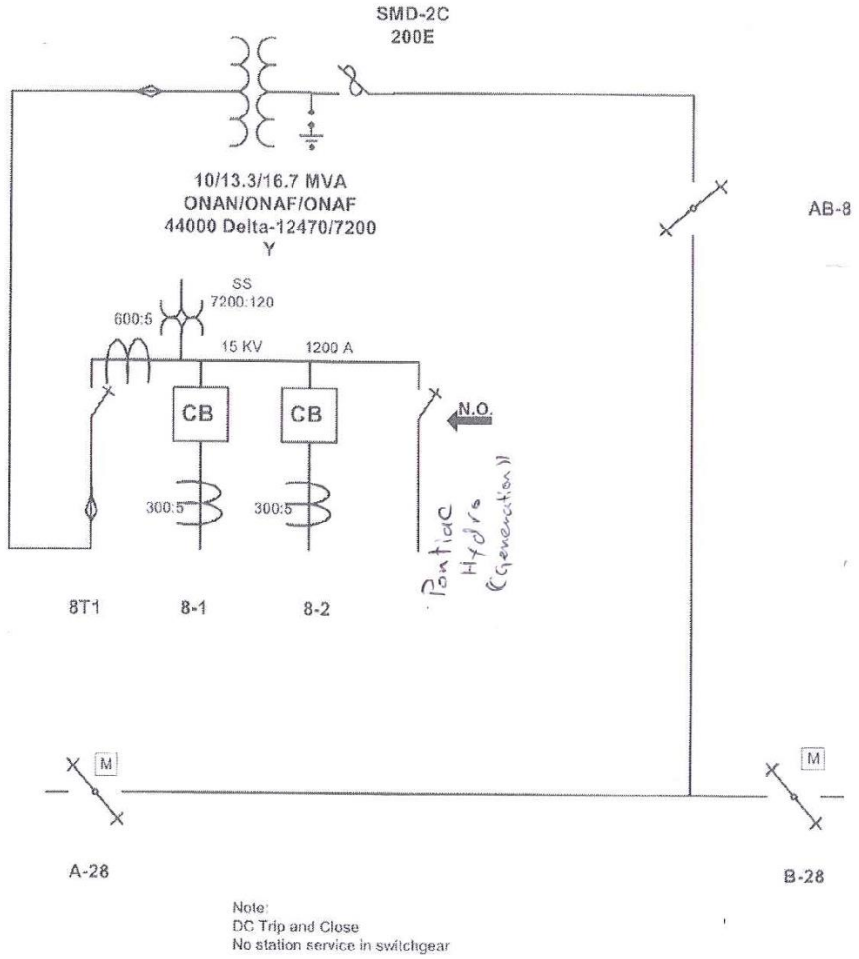

Figure 4-5: The SLD of Substation 8-Taylor of Pembroke TS.

Table 4-4: Pembroke TS Meters

Type	Point of Delivery	Account ID	Meter ID	Voltage (kV)	Name
Subordinate	-	1000025560	PHON001824	44	H1 39628242 - Pembroke TS - T1
Subordinate	-	1000025570	PHON002088	44	H1 39628242 - Pembroke TS - T2
Subordinate	-	200700540	J3690203	12.47	H1 39628242 - Pembroke DS T1
Subordinate	-	200700762	J3741650	LV	H1 39628242 - Wal Mart
Subordinate	-	200700061	J3690316	LV	H1 39628242 - Greenwood DS T1
Subordinate	-	200600844	J3694324	LV	H1 39628242 - 1600 Greenwood INC
Subordinate	-	501626309SP	J073472	44	H1 39628242 -Roseburg Forest Products Canada Ltd
Aggregate	**10516527**	-	-		**Pembroke TS**

Thus, the wholesale kWh purchased at different voltage levels are calculated as follows:

- Total kWh (HV) = (Pembroke TS–T1) × (1.006) + (Pembroke TS–T2) × (1.006) – (Walmart Canada Corp) × (1.034) × (1.01) – (Pembroke DS–T1) × (1.034) × (1.01) – (T1 Bank–Greenwood DS) × (1.034) × (1.01) – (1600 Greenwood Inc.) × (1.034) × (1.01) – (Roseburg Forest Products Canada Ltd.) × (1.034), which includes HV/MV transformer losses, MV sub-transmission line losses, MV/LV transformer losses and LV distribution line losses.
- Total kWh (MV) = (Pembroke TS–T1) + (Pembroke TS–T2) – (Walmart Canada Corp) × (1.01) – (Pembroke DS–T1) × (1.01) – (T1 Bank–Greenwood DS) × (1.01) – (1600 Greenwood Inc.) × (1.01) – (Roseburg Forest Products Canada Ltd.), which includes MV/LV transformer losses and LV distribution line losses.
- Total kWh (LV) = (Pembroke TS–T1)/ (1.01) + (Pembroke TS–T2) / (1.01)) – (Walmart Canada Corp) – (Pembroke DS–T1) – (T1 Bank–Greenwood DS) – (1600 Greenwood Inc.) – (Roseburg Forest Products Canada Ltd.) / (1.01)), which includes LV distribution line losses.

When Hydro One Networks Inc. is delivering power to ORPC, Total kWh (HV) > Total kWh (MV) > Total kWh (LV). When Hydro One Networks Inc. is receiving power from ORPC, Total kWh (LV) > Total kWh (MV) > Total kWh (HV).

Table 4-5: 2020 Wholesale kWh Purchased at Pembroke TS.

Month	Total kWh (HV)	Total kWh (MV)	Total kWh (LV)
1	11308684.06	11582291.67	11467615.51
2	10792036.34	11049952.87	10940547.4
3	8355968.789	8613479.12	8528197.149
4	6446735.012	6645714.24	6579915.089
5	5217971.164	5432457.13	5378670.426
6	5797532.69	6047811.76	5987932.436
7	8953666.669	9249617.12	9158036.752
8	5776895.426	6021500	5961881.188
9	4973204.22	5254535.56	5202510.455
10	5867320.293	6135352.67	6074606.604
11	7403699.785	7699960.51	7623723.277
12	10615569.11	10925282.61	10817111.5
Total	**91509283.56**	**94657955.26**	**93720747.78**

4.3. Brookfield

Brookfield (Pontiac Hydro) supplies Pontiac Line A (MS8) and Pontiac Line B (MS4) as shown in Figure 4-3. Meters ORPC33266 and ORPC32965 are located at 44KV MV level to measure the delivered power from Pontiac Hydro to ORPC.

Table 4-6: Brookfield Meters

Type	Point of Delivery	Account ID	Meter ID	Voltage (kV)	Name
Subordinate	-	PEM MS8	ORPC33266	44	Pontiac Line A (MS8) - REC
Subordinate	-	PEM MS4	ORPC32965	44	Pontiac Line B (MS4) - REC

Thus, the wholesale kWh purchased at different voltage levels are calculated as follows:

- Total kWh (HV) = (Pontiac Line A (MS8)-REC) × (1.034) + (Pontiac Line B (MS4)-REC) × (1.034), which includes HV/MV transformer losses, MV sub-transmission line losses, MV/LV transformer losses and LV distribution line losses.
- Total kWh (MV) = (Pontiac Line A (MS8)-REC) + (Pontiac Line B (MS4)-REC), which includes MV/LV transformer losses and LV distribution line losses.
- Total kWh (LV) = (Pontiac Line A (MS8)-REC) / (1.01) + (Pontiac Line B (MS4)-REC) / (1.01), which includes LV distribution line losses.

Table 4-7: 2020 Wholesale kWh Purchased at Brookfield.

Month	Total kWh (HV)	Total kWh (MV)	Total kWh (LV)
1	2160150.08	2089120	2068435.644
2	1746322.6	1688900	1672178.218
3	3333564.3	3223950	3192029.703
4	3436488.66	3323490	3290584.158
5	4517773.48	4369220	4325960.396
6	4349252.16	4206240	4164594.059
7	3613333.68	3494520	3459920.792
8	4819463.66	4660990	4614841.584
9	4233630.28	4094420	4053881.188
10	4018248.08	3886120	3847643.564
11	3247349.38	3140570	3109475.248
12	2046337.7	1979050	1959455.446
Total	**41521914.06**	**40156590**	**39759000**

When Pontiac Hydro is delivering power to ORPC, Total kWh (HV) > Total kWh (MV) > Total kWh (LV). When Hydro One Networks Inc., is receiving power from ORPC, Total kWh (LV) > Total kWh (MV) > Total kWh (HV).

4.4. Almonte TS

Almonte TS supplies Almonte PME - Hope St. and Almonte MS 3 lines as shown in Figure 4-6. Meter J3694537 is located at 44KV MV level to measure the delivered/received power from/by Hydro One Networks Inc., to/from ORPC. Meters J3694131 and ORPC31762 are located at 4.16KV LV level to measure the delivered power to Almonte MS 3 and Almonte MS 2.

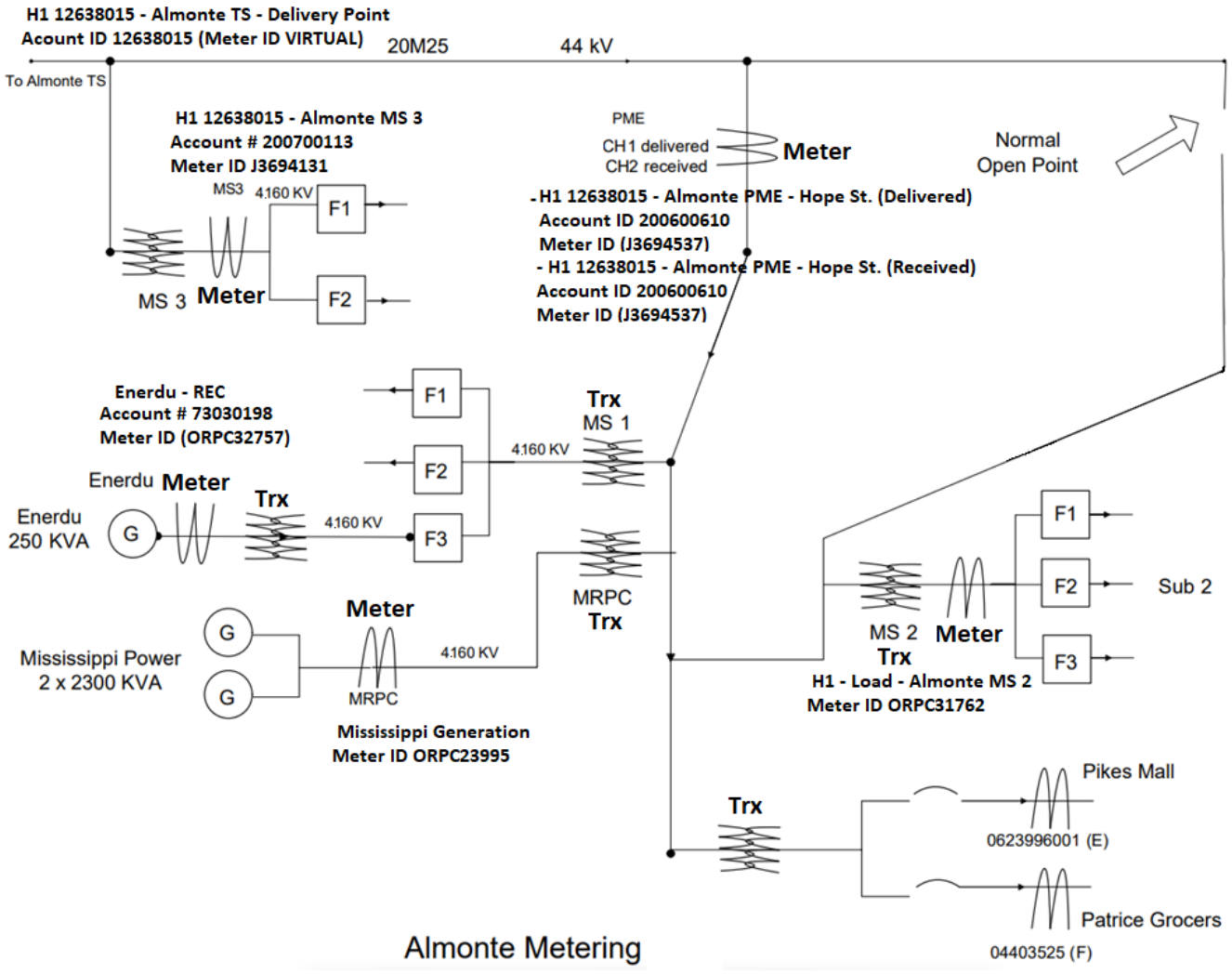

Figure 4-6: The SLD of Almonte TS.

Table 4-8: Almonte TS Meters

Type	Point of Delivery	Account ID	Meter ID	Voltage (kV)	Name
Subordinate	10701879	200600610	J3694537	44	H1 12638015 - Almonte PME - Hope St. (Del)
Subordinate	10701879	200600610	J3694537	44	H1 12638015 - Almonte PME - Hope St. (Rec)
Subordinate	-	H1 - Load - Almonte MS 2	ORPC31762	4.16	H1 - Load - Almonte MS 2
Subordinate	10245884	200700113	J3694131	4.16	H1 12638015 - Almonte MS 3
Aggregate	**10777291**	-	-		**ALmonte TS**

Thus, the wholesale kWh purchased at different voltage levels are calculated as follows:

- Total KWH (HV) = (Almonte PME–Hope St. (Del)) × (1.034) – (Almonte PME–Hope St. (Rec)) × (1.034) + (Almonte MS3) × (1.034)) × (1.01), which includes HV/MV transformer losses, MV sub-transmission line losses, MV/LV transformer losses and LV distribution line losses.
- Total kWh (MV) = (Almonte PME–Hope St. (Del)) – (Almonte PME–Hope St. (Rec)) + (Almonte MS3) × (1.01), which includes MV/LV transformer losses and LV distribution line losses.
- Total kWh (LV) = (Almonte PME–Hope St. (Del)) / (1.01) – (Almonte PME–Hope St. (Rec)) × (1.01) + (Almonte MS3 (Del)), which includes LV distribution line losses.

Table 4-9: 2020 Wholesale kWh Purchased at Almonte PME–Hope St. (Del).

Month	Total kWh (HV)	Total kWh (MV)	Total kWh (LV)
1	257578.5	249108.8008	246642.377
2	207192.9	200379.9807	198396.0205
3	7801.32	7544.796905	7470.095946
4	751.1	726.4023211	719.2102189
5	11132.46	10766.40232	10659.80428
6	1165478	1127154.739	1115994.791
7	3026240	2926731.141	2897753.605
8	1420201	1373501.934	1359902.905
9	725566.9	701708.8008	694761.1889
10	838933.8	811347.9691	803314.8208
11	501471	484981.6248	480179.8265
12	57452.35	55563.20116	55013.07046
Total	**8219799.33**	**7949515.793**	**7870807.716**

When Hydro One Networks Inc. is delivering power to ORPC, Total kWh (HV) > Total kWh (MV) > Total kWh (LV). When Hydro One Networks Inc. is receiving power from ORPC, Total kWh (LV) > Total kWh (MV) > Total kWh (HV).

Table 4-10: 2020 Wholesale kWh Purchased at Almonte PME–Hope St. (Rec).

Month	Total kWh (HV)	Total kWh (MV)	Total kWh (LV)
1	581106.4	561998.4	567618.384
2	740342.4	715998.4	723158.384
3	1490729	1441710.4	1456127.504
4	1589476	1537211.2	1552583.312
5	1604491	1551732	1567249.32
6	93681.23	90600.8	91506.808
7	0	0	0
8	4022.67	3890.4	3929.304
9	16250.34	15716	15873.16
10	23663.71	22885.6	23114.456
11	94903	91782.4	92700.224
12	975938.8	943848	953286.48
Total	**7214604.55**	**6977373.6**	**7047147.336**

Table 4-11: 2020 Wholesale kWh Purchased at Almonte MS3 (Del).

Month	Total kWh (HV)	Total kWh (MV)	Total kWh (LV)
1	1118806	1082017.408	1071304.364
2	988140.7	955648.646	946186.7783
3	914905.3	884821.3733	876060.7657
4	764178.9	739051.1605	731733.8223
5	736103.6	711899.0329	704850.5276
6	798050.9	771809.381	764167.704
7	1050919	1016362.669	1006299.673
8	836633.6	809123.4043	801112.2814
9	695172	672313.3462	665656.7784
10	807373	780824.9516	773094.0115
11	858065.8	829850.8704	821634.5252
12	1058897	1024078.337	1013938.947
Total	**10627245.8**	**10277800.58**	**10176040.18**

4.5. MRPC

Two 2300KVA MRPC generators supply power to Almonte TS as shown in in Figure 4-6. Meter ORPC23995 is located at 4.16KV LV level to measure the delivered power from MRPC to Almonte.

Table 4-12: MRPC Meter

Account ID	Meter ID	Voltage (kV)	Name
N/A	ORPC23995	4.16	Mississippi Generation

Thus, the wholesale kWh purchased at different voltage levels are calculated as follows:

- Total kWh (LV-Gen) = (Mississippi Generation), which includes LV distribution line losses, LV/MV transformer losses, and MV sub-transmission line losses.
- Total kWh (MV) = (Mississippi Generation) / (1.01), which includes LV distribution line losses, and MV sub-transmission line losses.
- Total kWh (LV-Load) = (Mississippi Generation) / ((1.01) × (1.005)), which includes LV distribution line losses.

When MRPC is delivering power to Almonte, Total KWH (LV-Gen) > Total KWH (MV) > Total KWH (LV-Load).

Table 4-13: 2020 Wholesale kWh Purchased at MRPC.

Month	Total kWh (LV-Load)	Total kWh (MV)	Total kWh (LV-Gen)
1	2620093.871	2633194.34	2659792
2	2669343.403	2682690.12	2709788
3	3338904.537	3355599.06	3389494
4	3088644.358	3104087.58	3135442
5	3113659.343	3129227.64	3160836
6	1185706.746	1191635.28	1203672
7	148141.4328	148882.14	150386
8	1026672.358	1031805.72	1042228
9	1213107.582	1219173.12	1231488
10	1253200.119	1259466.12	1272188
11	1697094.448	1705579.92	1722808
12	3155071.881	3170847.24	3202876
Total	**24509640.08**	**24632188.28**	**24880998**

4.6. Enerdu

One 250KVA Enerdu generator supplies power to Almonte TS as shown in in Figure 4-6. Meter ORPC32757 is located at <4.16KV LV level to measure the delivered power from Enerdu to Almonte.

Table 4-14: Enerdu Meter

Account ID	Meter ID	Voltage (kV)	Name
73030198	ORPC32757	< 4.16	Enerdu - REC

Thus, the wholesale kWh purchased at different voltage levels are calculated as follows:

- Total kWh (LV-Gen) = (Enerdu), which includes LV distribution line losses, LV/MV transformer losses, and MV sub-transmission line losses.
- Total kWh (MV) = (Enerdu) / (1.01), which includes LV distribution line losses, and MV sub-transmission line losses.
- Total kWh (LV-Load) = (Enerdu) / ((1.01) × (1.005)), which includes LV distribution line losses.

When Enerdu is delivering power to Almonte, Total kWh (LV-Gen) > Total kWh (MV) > Total kWh (LV-Load).

Table 4-15: 2020 Wholesale kWh Purchased at Enerdu.

Month	Total kWh (LV-Load)	Total kWh (MV)	Total kWh (LV-Gen)
1	598845.0304	601839.2556	607918.44
2	565730.4478	568559.1	574302.12
3	712686.995	716250.43	723485.28
4	683770.8945	687189.749	694131.06
5	677717.1144	681105.7	687985.62
6	238799.5871	239993.585	242417.76
7	81777.60199	82186.49	83016.66
8	210584.0995	211637.02	213774.72
9	221567.9104	222675.75	224925
10	236237.7612	237418.95	239817.12
11	336274.4677	337955.84	341369.52
12	662670.1194	665983.47	672710.58
Total	**5226662.029**	**5252795.34**	**5305853.88**

4.7. Microfit

Microfit supplies power to ORPC. Thus, the wholesale kWh purchased at different voltage levels are calculated as follows:

- Total kWh (LV-Gen) = (Microfit), which includes LV distribution line losses, LV/MV transformer losses, and MV sub-transmission line losses.
- Total kWh (MV) = (Microfit) / (1.01), which includes LV distribution line losses, and MV sub-transmission line losses.
- Total kWh (LV-Load) = (Microfit) / ((1.01) × (1.005)), which includes LV distribution line losses.

When Microfit is delivering power to ORPC, Total kWh (LV-Gen) > Total kWh (MV) > Total kWh (LV-Load).

Table 4-16: 2020 Wholesale kWh Purchased at Microfit.

Month	Total kWh (LV-Load)	Total kWh (MV)	Total kWh (LV-Gen)
1	6052.347809	6112.871287	6174
2	14443.68199	14588.11881	14734
3	30589.15793	30895.0495	31204
4	41764.53289	42182.17822	42604
5	51123.41927	51634.65347	52151
6	47607.09734	48083.16832	48564
7	49050.09313	49540.59406	50036
8	39376.53171	39770.29703	40168
9	34739.7314	35087.12871	35438
10	22326.24253	22549.50495	22775
11	15095.57886	15246.53465	15399
12	8855.014214	8943.564356	9033
Total	**361023.4291**	**364633.6634**	**368280**

5. CUSTOMER METERED kWh

This section shows the metered kWh at the ORPC customer's delivery point, i.e., the Net "Retail" kWh delivered by ORPC to its customers. Table 5-1 illustrates the ORPC customer metered kWh for 2020 for each month and the total metered kWh the whole year.

Table 5-1: 2020 Customer Metered kWh.

Month	Customer Class								Total
	G1	G2	G3	G4	RES	SL	UM	SN	
1	2,851,727	2,660,153	1,760,421	2,020,105	8,252,808	106,653	51,241	19,661	**17,722,769**
2	2,655,070	2,421,141	1,632,606	1,854,192	7,653,590	91,818	48,847	16,528	**16,373,792**
3	2,392,130	2,166,232	1,479,605	1,964,741	7,390,200	87,913	49,981	16,258	**15,547,060**
4	1,855,781	1,628,275	1,231,681	2,139,284	6,556,759	74,549	46,957	16,645	**13,549,931**
5	1,785,317	1,588,083	1,137,773	2,018,826	6,323,124	67,740	50,359	16,468	**12,987,690**
6	1,892,488	1,720,351	1,100,068	2,216,410	6,629,679	61,049	48,889	16,451	**13,685,385**
7	2,323,074	1,835,989	1,278,811	2,628,351	8,725,974	65,464	50,149	16,451	**16,924,263**
8	2,013,319	2,125,534	1,103,272	2,313,669	6,819,648	73,705	49,855	16,457	**14,515,459**
9	1,782,342	1,679,825	1,023,139	2,015,704	5,431,156	81,378	49,681	16,312	**12,079,537**
10	1,924,819	1,946,368	1,142,906	1,923,073	6,120,244	94,879	49,975	16,089	**13,218,353**
11	2,153,940	1,962,152	1,328,777	1,920,272	6,617,422	101,060	52,957	16,052	**14,152,632**
12	2,603,393	2,647,115	1,601,832	1,944,354	8,621,253	109,459	53,209	15,752	**17,596,367**
Total	**26,233,400**	**24,381,218**	**15,820,891**	**24,958,981**	**85,141,857**	**1,015,667**	**602,100**	**199,124**	**178,353,238**

6. TOTAL LINE LOSS CALCULATION

This section calculates the total distribution line losses in the ORPC system.

- Total Line losses = Wholesale kWh Purchased – Customer Metered kWh / Wholesale kWh Purchased.
- Where, Wholesale kWh Purchased = Cobden TS Total KWH (LV) + Pembroke TS Total KWH (LV) + Almonte PME–Hope St. (Del) Total KWH (LV) – Almonte PME–Hope St. (Rec) Total KWH (LV) + Almonte MS3 (Del) Total KWH (LV) + Brookfield Total KWH (LV) + MRPC Total KWH (LV-Load) + Enerdu Total KWH (LV-Load) + Microfit Total KWH (LV-Load).

Table 6-1 illustrates the resultant distribution line loss for 2020 for each month and the total line loss for the whole year, using the calculation methodology outlined above. This includes both the raw kWh value as well as the percentage (%).

Table 6-1: 2020 Total Line Loss Calculation.

Month	Wholesale kWh Purchased	Customer Metered kWh	Calculated Line Loss (kWh)	Calculated Line Loss (%)
1	18,846,231	17,722,769	1,123,462	6.0%
2	17,519,365	16,373,792	1,145,573	6.5%
3	16,374,239	15,547,060	827,179	5.1%
4	13,824,364	13,549,931	274,433	2.0%
5	13,552,392	12,987,690	564,702	4.2%
6	14,240,261	13,685,385	554,876	3.9%
7	17,821,145	16,924,263	896,882	5.0%
8	14,854,366	14,515,459	338,907	2.3%
9	12,818,143	12,079,537	738,606	5.8%
10	13,896,835	13,218,353	678,482	4.9%
11	14,974,437	14,152,632	821,805	5.5%
12	17,990,855	17,596,367	394,488	2.2%
Total	**186,712,632**	**178,353,238**	**8,359,394**	**4.5%**