EXH. CD-3
DOCKETS UE-240004/UG-240005
2024 PSE GENERAL RATE CASE
WITNESS: DR. CHHANDITA DAS

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY,** **Respondent.**	**Docket UE-240004** **Docket UG-240005**

SECOND EXHIBIT (NONCONFIDENTIAL) TO THE PREFILED DIRECT TESTIMONY OF

DR. CHHANDITA DAS

ON BEHALF OF PUGET SOUND ENERGY

FEBRUARY 15, 2024

Puget Sound Energy
Load Research Report

Class Load Profiling for July 2022 – June 2023

January 2024

Prepared by

Puget Sound Energy
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Puget Sound Energy

Load Research

Class Hourly Load Profiles

Table of Contents

Tables of Figures

List of Tables

Puget Sound Energy

Load Research

Class Hourly Load Profiles

1 INTRODUCTION

1.1 Background

The class hourly load profiles developed in this study are to support Puget Sound Energy's (PSE or the Company) electric cost-of-service (COS) study. The class hourly loads are estimated on the basis of the load data for the test-year period from July 2022 to June 2023. This analysis uses 15-minutes interval load data to develop hourly class profiles. Historically, PSE used interval load data for a statistically selected sample of customers which were collected by the Company's automated meter reading (AMR) or advanced metering infrastructure (AMI) network for most non-system rate classes. The sample data were validated and then expanded to the population for each rate class using well-founded statistical methods to estimate class level load profiles. In 2018, PSE started AMI meter deployment for all customers which allows 15-minutes interval load data to be available for most customers.[1] For the current analysis, PSE is using all customers' meter data currently available with one year of historical data. This approach allows PSE to be compliant with the WAC cost of service rule (480-85-050) requiring utilities to use interval load data in place of a sample-based load study.

In support of the 2024 GRC, PSE staff used all available data for residential, 8, 24, 25, 31 and 43 rate schedules to estimate the class load profiles. In addition, PSE used the available data to estimate load profiles for net meter customers for schedule 7, 24 (C & I) and 25 commercial customers. The methodology used to estimate the net meter load profiles is same as the non-net meter customers.

Interval load data for the full populations of large commercial and industrial (C&I) rate classes, such as Classes 46, 49, 449PV, 449HV, 459 and Special Contract are compiled by the MV-90 metering system. For these non-system rate classes as well as rate classes with few customers such as 5 & 35, interval load data for the full population are available. Therefore for these rate classes, full population data were used to estimate class load profiles. The class load profiles for these rate classes are referred to in this report as "deemed" profiles since they have been calculated for the entire class.

The rate classes studied in this rate case are listed in Table 1.

[1] Currently, interval data are not available for 100% of the customer for the time period analyzed to support the 2024 rate case.

PSE System Load	
Rate Class	**Description**
7	Residential
5	Sales for Resale
8 & 24	Small General Services <50 kW
11 & 25	Medium General Services 50-350 kW
12 & 26	Large General Service >350 kW
29	Seasonal Irrigation
10 & 31	Primary Voltage General Service
35	Primary Voltage Seasonal Irrigation
43	Primary Voltage Interruptible Service For Total Electric School
46	High Voltage Interruptible Service
49	High Voltage General Service
50 - 59	Street & Area Lighting
PSE Non System Load	
Rate Class	**Description**
449HV	Retail Wheeling - High Voltage
449PV	Retail Wheeling - Primary Voltage
459	Back-up Generation
Special Contract	Retail Wheeling & Distribution Service

Table 1 – Rate Classes[2] Analyzed

This study yields the following outputs:

- Hourly load profiles for the test year by rate class
- Hourly load profiles for the net meter customers by rate class
- General class and customer summaries including:
  - Monthly coincident peaks and non-coincident peaks by rate class;
  - Average customer load
  - Top 12 peak hours average coincident peak demands and mid-winter month (Nov. – Feb.) system peak hour average coincident peak demand (4CP) by class; and
  - Top 12 non-coincident peaks by class;

2 METHODOLOGY

In this section, we discuss the data and methodology used to estimate the class load profiles. In addition, we include summaries of the system load and annual class sales.

For the 2024 GRC load study, PSE hired DNV Energy Insights, a consulting company, specializing in load research to assist with analyzing hourly interval data for over 1 million customers. Currently, PSE does not have a system in place to process such a large volume of data and validate data quality. Therefore PSE leveraged DNV Energy Insight's expertise on the subject matter and resources to

[2] Non-System loads are PSE's transportation or "Retail Wheeling" class loads.

analyses the electric customer load data to support the 2024 cost of service study. The analysis approach used by DNV in this study follows the load research methodology detailed in **appendix B – analysis** approach **Approach**. The analyses used available hourly data for most customers with highly correlated information, e.g., annual billing data that is known for the full population of customers. While the samples used in this study approached a census, it was still necessary to develop a stratification schema based on the population billing data and map the available sample data to the appropriate stratum for the purpose of calculating case weights for use in the analysis. The case weights for each analysis class have been included in the associated tables in the result section below.

2.1 Analysis Overview

In general, the following steps were taken to develop the class hourly load profiles and the information needed for electric cost of service studies. These steps are consistent with the analysis steps adopted in the past GRC studies.

1. The first step in this process is to identify the population frame of interest. This is accomplished by summarizing current billing data on the full complement of customers on each of the rate class and domain of interest.
2. The next step in this process is to extract and compile the 15-minute interval load data, and aggregate them to hourly loads for all customers from the population for which interval data were available.
3. Next, the interval data goes through an extensive verification, editing and estimation (VEE) process to maximize the volume of data that could be used for analyses. The following criterion were used to perform VEE on the hourly usage data:
    - Meter to billing comparison
    - Spike checks
    - Missing interval checks, and
    - weather modelling to fill in missing data
4. Since currently, interval data are not available for the whole population for each rate class, the next step is to use the available data in classic load research analysis framework to extrapolate the sample to the full population of interest. This starts by matching the available sample data to the various schedules and domains of interest to create case weights for use in the analysis. Case weights are simply the number of customers in the population represented by each sample point. If a rate class has data for its entire population, the case weights will be at 1.0 for that rate class. Next, case weights are applied to estimate daily use for each class-domain.
5. The estimated daily loads are then trued up to the official annual sales totals to get the preliminary daily load profiles. This weighted analysis yields the best estimate of the daily total for each domain that are rolled up to the classes of interest to yield class load before loss. The step was executed for Commercial (C), Industrial (I), net meter, and non-net meter customers separately.
6. The population expansions were then used to estimate average loss factors for each delivery voltage and rate class. The loss factors were then applied to the class hourly load estimates to produce the class hourly load estimates with losses;

7. The hourly load estimate with loss for each rate class were summed for all of the system rate classes and compared with the actual system hourly load. This results in a residual load known as unaccounted for energy[3] (or UFE); and
8. Finally, the UFE was applied to each rate class based on the proportion of the rate class contribution to the individual hourly load yielding the reconciled class load. Since the hourly load profiles for "deemed profiles" (Rate Classes 5, 35, 46, 49, special contract and lighting classes) provides actual interval load data, UFE allocation was done among only the system rate classes for which the population expansions were required.
9. The UFE adjusted load profiles for the C & I, and net meter and non-net meter hourly profiles are then aggregated to get the final hourly rate class load profiles.
10. Finally, the hourly rate class level load profiles are used to calculate a range of summary statistics and charts to support Cost of Service study.

2.2 Population Frame

To construct a population frame for the analysis, the monthly billing data for the full population identified above were used. Table 1 presents a summary of the population data used in the analysis by rate schedule. Note, for some of the rate classes, such as residential, small and medium commercial, net meter and non-net meter customers were treated separately. In addition, where applicable, commercial and industrial classes were treated separately. At the final stage, net meter and non-net meter and C & I profiles were added to estimate the final class profile. There were twelve system rate schedules and four non-system rate schedules and sixteen domains of interest covered in this study.

The following summarizes the system rate class from Table 1:

1. Schedule 7: Residential
2. Schedules 8 & 24: Secondary Voltage General Service with demands of 50 kW or less,
3. Schedules 11 & 25: Secondary Voltage General Service "Small" demands between 50 kW and 350 kW,
4. Schedules 12& 26: Secondary Voltage General Service "Large" demands greater than 350 kW,
5. Schedule 5: Sale for resale customer
6. Schedule 29: Secondary Voltage Seasonal Irrigation & Drainage Pumping Service,
7. Schedules 10 & 31: Primary Voltage General Service,
8. Schedule 35: Primary Voltage Seasonal Irrigation & Drainage Pumping Service,
9. Schedule 43: Primary Voltage Interruptible Service for Total Electric Schools,
10. Schedule 46: High Voltage Interruptible Service, and
11. Schedule 49: High Voltage General Service.
12. Schedule 50-59: Area lighting and Street Lighting

In addition, hourly load profiles were developed for four non-system tariff rate classes:

13. Schedule 449HV - Retail Wheeling High Voltage,

14. Schedule 449PV - Retail Wheeling Primary Voltage,
15. Schedule 459 - Back-up Generation,
16. Special Contract – Retail Wheeling and Distribution Service.

2.3 Available Sample Data and Case Weights

The project used hourly data available for the full complement of customers for the period July 1, 2022 through June 30, 2023. Since the AMI deployment is not yet complete for PSE's electric territory, hourly data are not available for all customers contained in the population frame. In addition, data might be missing for a variety of reasons including metrology, communication issues, outages or equipment failure. Prior to analysis, the available sample data are subjected to a series of quality checks. This is termed the validation, editing and estimation (VEE) process. Appendix A provides additional detail on the VEE process checks. During the VEE process some sites were removed based on specific criterion established that included:

- Required to have data for at least 50% of the days,
- Required to have data in the analysis year,
- Required to have data in the last six-months, and
- Required to have positive consumption.

Table 2 present a summary of the hourly data available for this analysis after VEE. These tables show population counts, the number of customers with available daily data, and the percentage of data that are available and used in the analysis. Net meter customers has bi-directional energy flows; one direction is from grid to meter (delivered energy) and another direction is from meter to grid (received energy). For these customers, only those devices that have complete data for both directions are included in the analyses. Overall, 99% of the device locations with hourly data were used for analyses, however the percentage coverage varies across rate schedules from 32% to 100%.

Rate Schedule	Meter Type	Population	Sample	Percentage
7	Net Meter	17,635	9,229	52%
7	Non Net Meter	1,067,873	1,067,873	100%
8 & 24 (Commercial)	Net Meter	875	341	39%
8 & 24 (Commercial)	Non Net Meter	135,806	135,806	100%
8 & 24 (Industrial)	Net Meter	3	2	67%
8 & 24 (Industrial)	Non Net Meter	2,947	1,761	60%
11 & 25 (commercial)	Net Meter	53	28	53%
11 & 25 (Commercial)	Non Net Meter	8,069	3,768	47%
11 & 25 (Industrial)	Non Net Meter	472	251	53%
12 & 26 (Commercial)	Non Net Meter	804	515	64%
12 & 26 (Industrial)	Non Net Meter	91	59	65%
29	Non Net Meter	746	237	32%
10 & 31 (Commercial)	Non Net Meter	367	229	62%
10 & 31 (Industrial)	Non Net Meter	118	73	62%
43	Non Net Meter	143	100	70%
Total		1,236,002	1,220,272	99%

Table 2 – Number of Device Locations Used for Class Load Profiling after VEE

2.4 Annual Sales by Rate Class

Table 3 shows the number of accounts, total annual sales in kWh, and the average annual kWh sales per account in each rate class for the study period of July, 2022 to June, 2023.

Rate Class	Description	No. of Accounts	Total Annual kWh Use	Avg. kWh Use per Account	% of Total kWh Sales
7	Residential	1,071,481	11,731,755,849	10,949	54.24%
5	Sales for Resale	8	6,950,360	868,795	0.03%
8 & 24	Small General Services <50 kW	125,774	2,796,488,007	22,234	12.93%
11 & 25	Medium General Services 50-350 kW	8,158	3,026,718,350	371,016	13.99%
12 & 26	Large General Service >350 kW	854	1,823,650,286	2,136,464	8.43%
29	Seasonal Irrigation	626	13,571,856	21,672	0.06%
10 & 31	Primary Voltage General Service	501	1,389,392,591	2,771,856	6.42%
35	Primary Voltage Seasonal Irrigation	2	5,272,770	2,636,385	0.02%
43	Primary Voltage Interruptible Service For Total Electric School	143	126,106,861	879,304	0.58%
46	High Voltage Interruptible Service	6	96,359,415	16,059,903	0.45%
49	High Voltage General Service	17	545,881,806	32,110,694	2.52%
50 - 59	Street & Area Lighting	9,096	66,745,093	7,338	0.31%
System Total		1,216,667	21,628,893,244	17,777	100.00%
Non System Loads					
449HV	Retail Wheeling - High Voltage	11	1,646,935,329	149,721,394	72.65%
449PV	Retail Wheeling - Primary Voltage	1	11,830,913	11,830,913	0.52%
459	Back-up Generation	3	291,535,781	97,178,594	12.86%
Special Contract	Retail Wheeling & Distribution Service	89	316,656,904	3,557,943	13.97%
Non System Totals		104	2,266,958,928	21,797,682	100.00%

Table 3 – Population Counts[4] and Consumption[5] Data[6]

The Residential class (Schedule 7) contains 1,071,481 accounts (88% of all accounts) with a total annual energy use of 11,731 GWh (54.24% of the total system energy use). The average annual use per residential customer is 10,949 kWh. The small and medium general service contains 11% of all accounts with a total energy use of 5,823 GWh (27% of total system energy use). The large general service class contains 0.1% of all accounts with a total annual energy use of 1,823 GWh (8.43% of total system energy use).

Among the non-system rate classes, retail wheeling accounts for 73% of total non-system energy use and special contract class accounts for 13.97% of total non-system energy use.

Figure 1 shows how the total PSE system loads are composed of the class loads during the annual system peak demand week. As shown in the graph, the Residential class contributes to the largest share of the system peak demand and the Small C&I class is the second largest contributor to the system peak. Figure 1 also superimposes non-system loads on top of the system loads to illustrate the total loads transmitted by PSE during its system peak week.

[4] Number of Accounts is average of monthly account counts for the test period ranging from July, 2022 to June, 2023.

[5] Total Annual Energy Use is the annual delivered energy sales (billed & unbilled) for the test period from July, 2022 to June, 2023.

[6] Note, this analyses does not account for the customer migration that takes place beyond the test year of June 30, 2023.

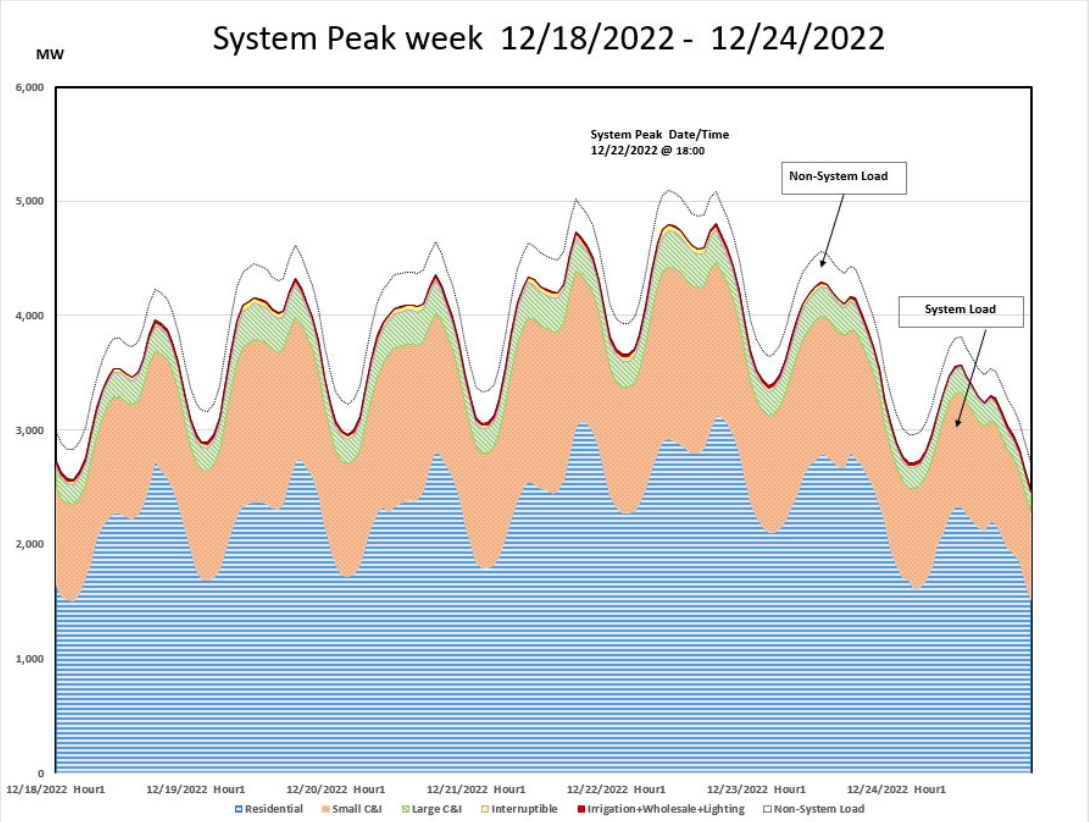

Figure 1 – Composition of System Load during Annual System Peak Week

3. SYSTEM AND CLASS LOAD PROFILES

This section presents the total system load and final shapes for each system rate classes. The final shapes for the system rate classes reflects hourly loads after loss and reconciled to the system load which are developed by using the validated and compiled data from Section 2.3**Error! Reference source not found.**. The non-system load profiles are obtained after applying the loss factor to the validated data but they do not go through population expansion and system reconciliation steps. The average loss factors applied to different rate classes are shown in Table 4.

Rate Class	Loss Factor
SCH_7	7.64%
SCH_24	10.08%
SCH_25	10.04%
SCH_26	10.03%
SCH_29	9.95%
SCH_31	4.45%
SCH_35	4.52%
SCH_43	4.39%
SCH_46	1.83%
SCH_49	1.69%
SCH_5	4.49%
SCH_50	10.87%
SCH_55	10.87%
SCH_SC	3.28%
SCH_449HV	1.78%
SCH_449PV	3.82%
SCH_459HV	1.78%

Table 4 – Estimated Loss Factor by Rate Class

3.1 Total System Load

This section described the system load for the study year. Figure 2 presents a two-dimensional time series plot of the PSE system load during the 12-month period ending June 30, 2023. Figure 2 also shows a vertical EnergyPrint, and illustrates energy use intensity by hour, day and month. In the vertical EnergyPrint, the days are measured on the y-axis and hours of the day on the x-axis. The load is displayed using the color scale shown on the top of the plot. In this case, the EnergyPrint shows that the PSE system load is winter peaking with the highest demands in the early morning (i.e., 6AM to 9AM) and early evening (i.e., 5 PM to 8 PM) periods during the months of November through March. The PSE system load peaked at 4,807 MW on Thursday December 22, 2022, at 6 PM.

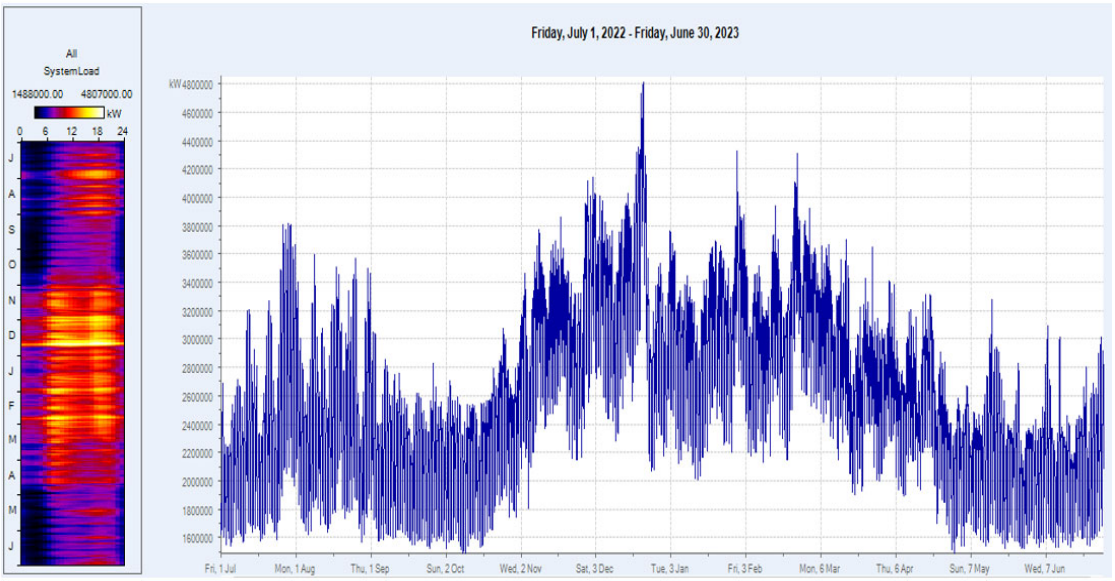

Figure 2 – PSE System Load

Table 5 summarizes the monthly statistics from the system loads for the twelve months ending June 30, 2023. The total monthly peak demand varied from a low of 3,044 MW in September 2022 to the high of 4,807MW in December 2022. The monthly load factor of the system varied from 62% to 73.6%.

Month	Monthly Energy Use (MWh)	Date of System Peak	Time of System Peak	System Peak Demand (MW)	Load Factor (%)
Jul-22	1,763,020	Thursday, July 28, 2022	18	3,819	62.0%
Aug-22	1,818,004	Monday, August 8, 2022	18	3,597	67.9%
Sep-22	1,561,925	Thursday, September 1, 2022	18	3,044	71.3%
Oct-22	1,658,088	Tuesday, October 25, 2022	19	3,071	72.6%
Nov-22	2,151,536	Tuesday, November 29, 2022	18	4,114	72.6%
Dec-22	2,448,940	Thursday, December 22, 2022	18	4,807	68.5%
Jan-23	2,226,703	Monday, January 30, 2023	9	4,329	69.1%
Feb-23	2,062,110	Friday, February 24, 2023	8	4,308	71.2%
Mar-23	2,103,308	Wednesday, March 1, 2023	8	3,925	72.0%
Apr-23	1,806,766	Monday, April 3, 2023	9	3,411	73.6%
May-23	1,611,120	Monday, May 15, 2023	18	3,276	66.1%
Jun-23	1,540,456	Wednesday, June 7, 2023	19	3,090	69.2%
Annual	22,751,976	Thursday, December 22, 2022		4,807	54.0%

Table 5 – Monthly System Total and Peak Demands

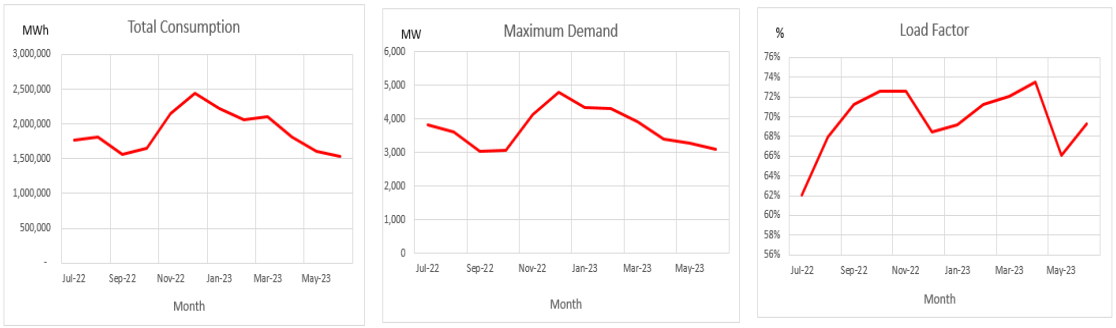

Figure 3 – Monthly System Energy, Demand and Load Factor

Figure 3 presents monthly system energy requirement, peak demand and load factor in graphics. Figure 4 shows the 24-hour profile of the total system load on the day when PSE system hit its annual peak load. The annual peak load day happens usually in the winter and is bi-modal with mid-morning and early evening peaks. Winter is defined as the October through May period with summer defined as June through September.

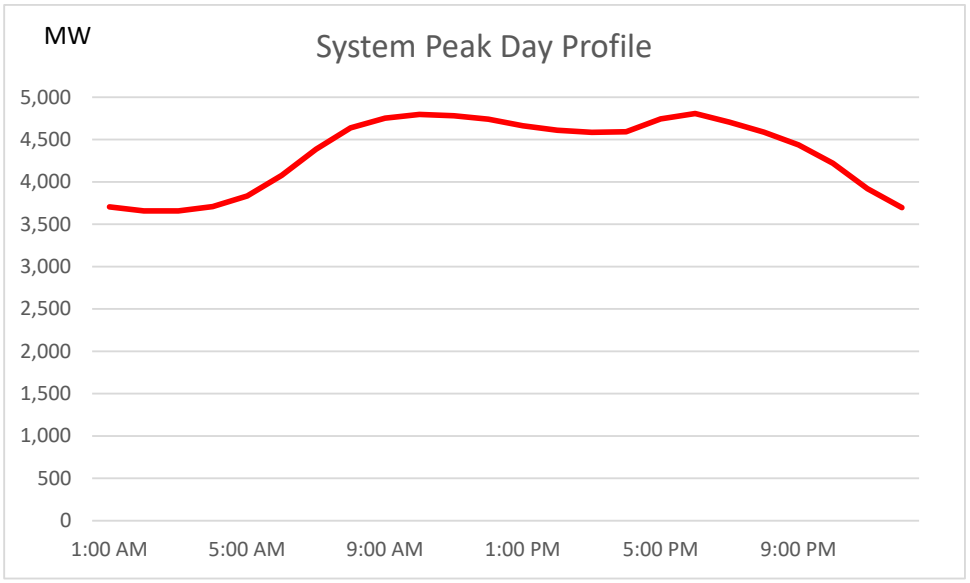

Figure 4 – Hourly Load Profile on Annual System Peak Day (December 22, 2022)

3.2 Residential Class (Schedule 7)

The residential class profiles are estimated by using data for all customers for which AMI data were available. Since residential class consists of many net meter customers, the class profiles are estimated separately for net meter and non-net meter customers and then added up to get the final class profile. The non-net meter class profiles are based on 99.6% of the population data and hence no post stratification was needed. For the net meter profiles, 52% of the population had interval data and therefore class profiles were estimated by expanding the sample data via post-stratification. Table 6 presents the post-stratification done for sample expansion to population using a case weighting

scheme for the net meter customers. The table shows population count, number of sample points and case weight by annual energy usage bracket. For net meter customers, the delivered energy was used as the stratification variable.

Maximum kWh	N(h)	n(h)	Case Weights
Net Meter Customers (Forward and Reverse Channels)			
8,030	6,705	3,626	1.85
11,680	3,970	2,102	1.89
16,060	3,061	1,518	2.02
22,995	2,369	1,210	1.96
174,470	1,530	773	1.98
Total	17,635	9,229	9.69

Table 6 – Residential Class Post-Stratification

In the second stage of analysis, the line loss factor of 7.64% estimated for the Residential class was applied to the hourly load estimated at a premise metering point. The estimated line loss factor is an annual average loss factor and was applied uniformly to all 8,760 hourly loads estimates for each customer types. The hourly load estimates including line losses were preliminary estimates of residential class's contribution to system's hourly demand. Finally, the residential hourly load estimates are reconciled to the system hourly loads by allocating the unaccounted for energy (UFE) to the Residential class on the basis of preliminary percentage estimate of its contribution to the system demand for that particular hour.

Figure 5 presents the results of the reconciled hourly expansion analysis for the Residential class. The figure displays the EnergyPrint to the left of a more standard two-dimensional x-y plot. The vertical form of the EnergyPrint displays time on the x-axis, day of the year on the y-axis and the magnitude of the load on the z-axis. The magnitude of load is displayed as a color gradient with low levels of load in the black-blue spectrum and high levels of load in the yellow-white spectrum. The dominance of the winter load is clearly evident with bi-modal peaks occurring in the morning and early evening periods. The Residential class peak 3,130 MW occurred at 6 PM on Thursday, December 22, 2022, which coincided with system peak day and time.

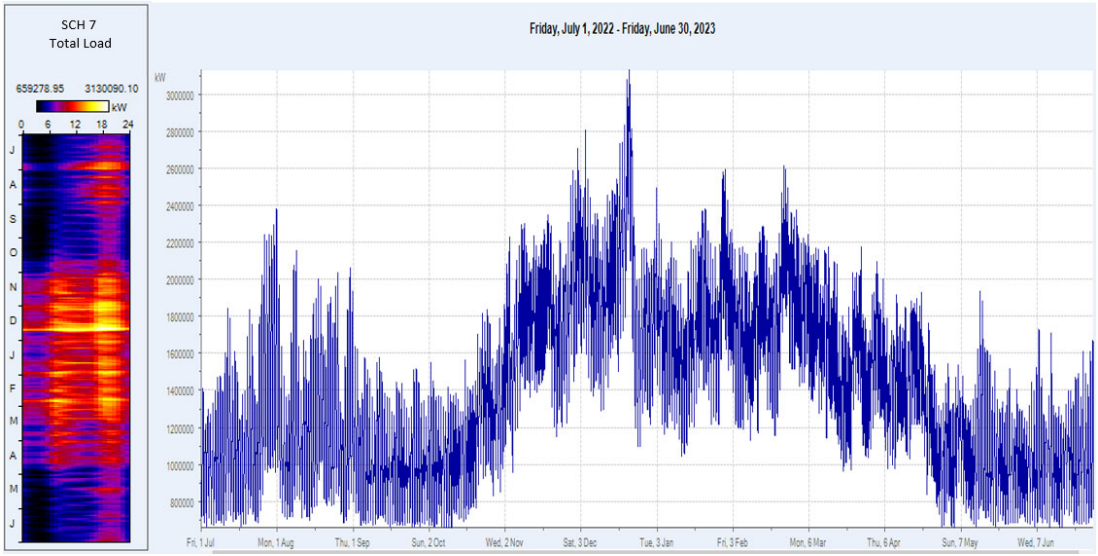

Figure 5 – Residential Class Total Load

Figure 6 presents the Residential class load during the system peak week of Sunday, December 18, 2022, through Saturday, December 24, 2022. The Residential class had a coincidence factor of 100% because class peak occurred at the same time of system peak, which was at 6 PM on Thursday December 22, 2022.

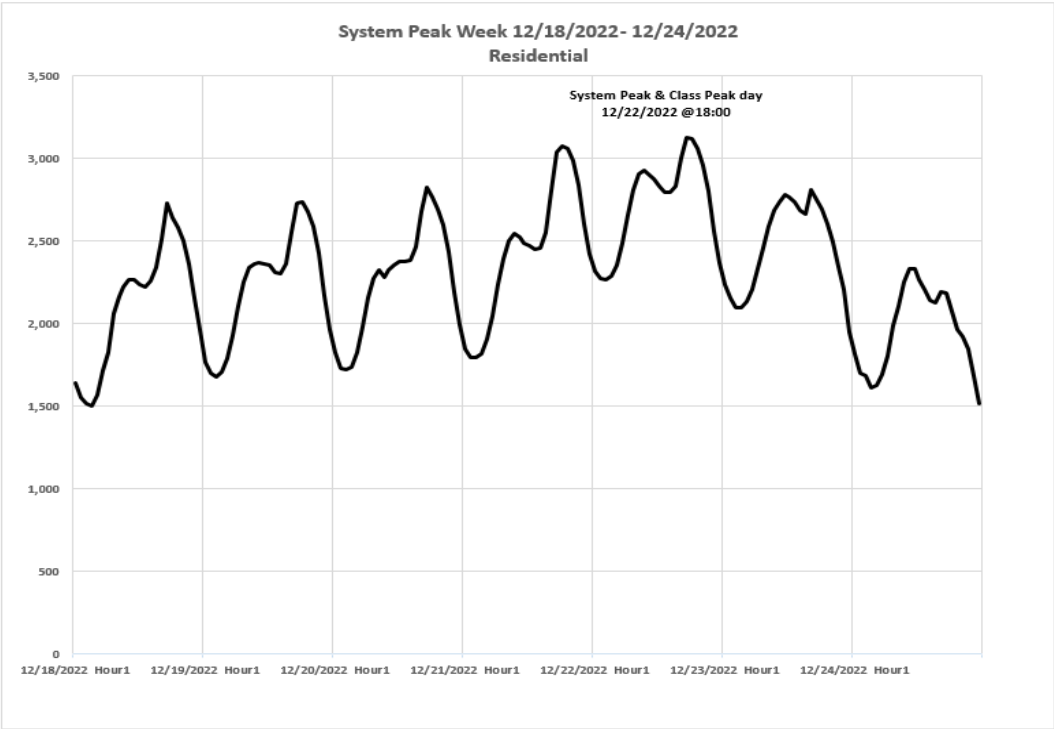

Figure 6 – Residential Class: Total Load during System Peak Week

Figure 7 presents the monthly Residential class energy consumption, peak demand and load factor in graphics.

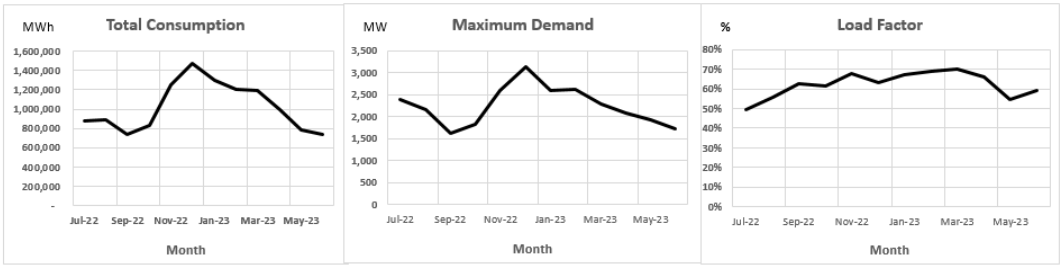

Figure 7 – Residential Class: Monthly Energy, Demand and Load Factor

Achieved precision associated with the Residential class analysis can be evaluated in terms of the deviation of the sum of Residential class hourly loads net of losses estimated for the 12 months ending June 2023 from the total actual sales to the class in the same 12-month period. The sum of estimated Residential hourly loads net of losses is 11,350,281 MWh, 3.25% lower than the actual delivered Residential energy sales of 11,731,755 MWh. The implied error percentage is significantly lower than the maximum error margin of ±10% tolerated in a typical load research practice.

Table 7 presents summary statistics for the Residential class load after applying losses and reconciliation to the system load. The table displays class totals and includes monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak (i.e., class system-coincident peak load) and coincidence factor calculated as the class coincident peak divided by the class non-coincident peak demand. In addition, the table displays other summary characteristics including:

- 12-month average coincident peak contribution;
- Average class demand associated with top 12, 75 and 200 system peak hours;
- Average class demand associated with top 12, 75 and 200 class peak hours; and
- 4 winter-month (Nov. –Feb.) average coincident peak contribution.

Residential monthly class non-coincident peak (NCP) load factors ranged from a low of 49.6% in July 2022 to a high of 70% in March, 2023. The Residential load coincides heavily with the system peak displaying a system peak coincidence factor of at or over 90% for all of the 12 months of the study period, with the maximum of 100% occurring in four out of twelve months.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	877,797,011	Sunday, July 31, 2022	19	2,380,723	1,179,835	49.6%	Thursday, July 28, 2022	18	2,177,437	91.5%
Aug-22	895,628,171	Monday, August 8, 2022	19	2,155,596	1,203,801	55.8%	Monday, August 8, 2022	18	2,042,674	94.8%
Sep-22	734,384,323	Thursday, September 1, 2022	19	1,632,465	1,019,978	62.5%	Thursday, September 1, 2022	18	1,560,125	95.6%
Oct-22	834,848,054	Tuesday, October 25, 2022	19	1,831,933	1,122,108	61.3%	Tuesday, October 25, 2022	19	1,831,933	100.0%
Nov-22	1,256,495,049	Tuesday, November 29, 2022	19	2,585,397	1,745,132	67.5%	Tuesday, November 29, 2022	18	2,583,146	99.9%
Dec-22	1,477,118,528	Thursday, December 22, 2022	18	3,130,090	1,985,374	63.4%	Thursday, December 22, 2022	18	3,130,090	100.0%
Jan-23	1,297,908,150	Monday, January 30, 2023	19	2,591,083	1,744,500	67.3%	Monday, January 30, 2023	9	2,544,732	98.2%
Feb-23	1,205,110,315	Thursday, February 23, 2023	20	2,611,543	1,793,319	68.7%	Friday, February 24, 2023	8	2,594,203	99.3%
Mar-23	1,192,955,023	Wednesday, March 1, 2023	8	2,289,724	1,603,434	70.0%	Wednesday, March 1, 2023	8	2,289,724	100.0%
Apr-23	991,963,136	Sunday, April 2, 2023	20	2,091,932	1,377,727	65.9%	Monday, April 3, 2023	9	1,875,154	89.6%
May-23	786,819,782	Sunday, May 14, 2023	20	1,931,322	1,057,553	54.8%	Monday, May 15, 2023	18	1,831,178	94.8%
Jun-23	738,146,888	Wednesday, June 7, 2023	19	1,727,836	1,025,204	59.3%	Wednesday, June 7, 2023	19	1,727,836	100.0%
Annual	12,289,174,431	Annual Class Peak		3,130,090	1,402,874	44.8%	Annual System CP		3,130,090	100.0%
		Average 12 Monthly NCPs		2,246,637		62.4%	Average 12 Monthly CPs		2,182,353	97.1%
		Average Top 12 NCPs		3,014,650		46.5%	Average Top 12 CPs		2,973,774	98.6%
		Average Top 75 NCPs		2,720,294		51.6%	Average Top 75 CPs		2,655,744	97.6%
		Average Top 200 NCPs		2,532,994		55.4%	Average Top 200 CPs		2,469,261	97.5%
							Average 4CPs *		2,713,043	

* Monthly CPs for November, December, January and February

Table 7 – Residential Class: Summary Statistics (Totals – kW)

Table 8 presents the data on an average-per-customer basis. The average Residential customer used 11,469 kWh during the 12 months ending June 2023 and had an annual peak demand of 2.92 kW.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	824	Sunday, July 31, 2022	19	2.23	1.11	49.6%	Thursday, July 28, 2022	18	2.04	91.5%
Aug-22	840	Monday, August 8, 2022	19	2.02	1.13	55.8%	Monday, August 8, 2022	18	1.92	94.8%
Sep-22	688	Thursday, September 1, 2022	19	1.53	0.96	62.5%	Thursday, September 1, 2022	18	1.46	95.6%
Oct-22	781	Tuesday, October 25, 2022	19	1.71	1.05	61.3%	Tuesday, October 25, 2022	19	1.71	100.0%
Nov-22	1,174	Tuesday, November 29, 2022	19	2.42	1.63	67.5%	Tuesday, November 29, 2022	18	2.41	99.9%
Dec-22	1,378	Thursday, December 22, 2022	18	2.92	1.85	63.4%	Thursday, December 22, 2022	18	2.92	100.0%
Jan-23	1,210	Monday, January 30, 2023	19	2.42	1.63	67.3%	Monday, January 30, 2023	9	2.37	98.2%
Feb-23	1,123	Thursday, February 23, 2023	20	2.43	1.67	68.7%	Friday, February 24, 2023	8	2.42	99.3%
Mar-23	1,110	Wednesday, March 1, 2023	8	2.13	1.49	70.0%	Wednesday, March 1, 2023	8	2.13	100.0%
Apr-23	923	Sunday, April 2, 2023	20	1.95	1.28	65.9%	Monday, April 3, 2023	9	1.74	89.6%
May-23	731	Sunday, May 14, 2023	20	1.80	0.98	54.8%	Monday, May 15, 2023	18	1.70	94.8%
Jun-23	686	Wednesday, June 7, 2023	19	1.61	0.95	59.3%	Wednesday, June 7, 2023	19	1.61	100.0%
Annual	11,469	Annual Class Peak		2.92	1.31	44.8%	Annual System CP		2.92	100.0%

Table 8 – Residential Customer: Summary Statistics (Means – kW)

3.3 Schedule 05 Sales for Resale

The interval load data were collected from all of the eight resale metering device locations under Schedule 05. The interval load data were verified, edited and integrated to form an hourly load shape. Since the interval load data cover the whole population of the sales for resale customers, there is no need for sample post-stratification and expansion. In the next step, an average loss factor of 4.49% was applied to the hourly load data to produce the class hourly load profile with losses. The estimated average loss factor by rate schedule is presented in Table 4.

Figure 8 presents the total load for Schedule 05. The figure displays the EnergyPrint to the left of a two-dimensional x-y plot. The dominance of the winter load is clearly evident. The Schedule 05 class load peaked on December 22, 2022 at 9 PM. The peak demand was 3,096 kW.

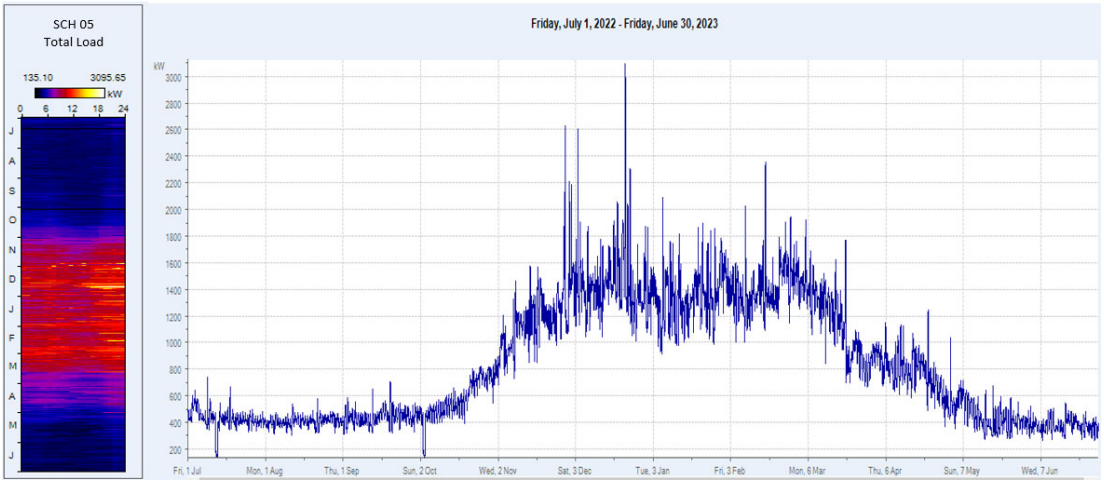

Figure 8 – Schedule 05: Class Total Load

Figure 9 presents Schedule 05 class loads during the system peak week of Sunday, December 18, 2022 through Saturday, December 24, 2022. The total Schedule 05 load at the time of the system peak was 2,598 kW.

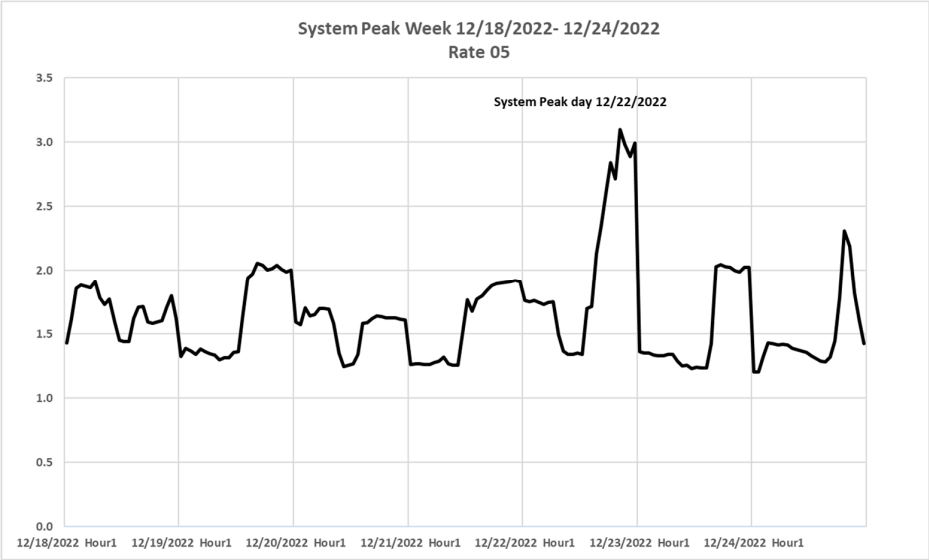

Figure 9 – Schedule 05: Total Load during System Peak Week

Figure 10 presents the monthly Sales for Resale class energy consumption, peak demand and load factor in graphics.

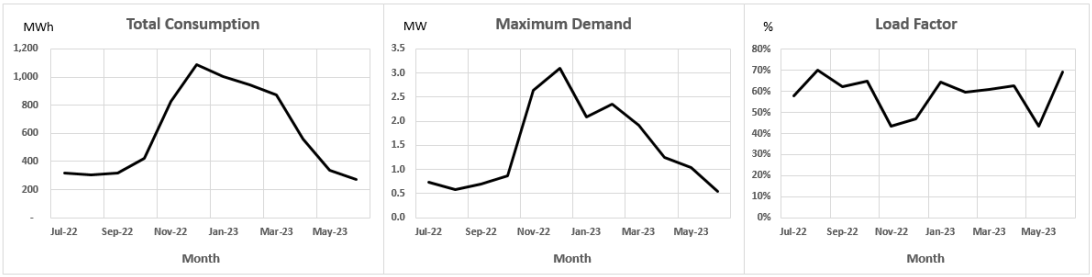

Figure 10 – Schedule 05: Class Monthly Energy, Demand and Load Factor

Achieved precision associated with the deem profiles are perfect. Since population data are available for all customers and they are all reconciled with the delivered load, the precision is perfect for this class.

Table 9 presents system total summary statistics for the Schedule 05 class load. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month average coincident peak contribution and class peaks, 4 winter-month average coincident peak contribution, average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. Monthly NCP load factors ranged from a low of 43.6% to a high of 70.1% in August, 2022. The Schedule 05 load is fairly coincident with the system peak during the peak winter season displaying system peak coincidence factors of 83.9%.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	317,869	Friday, July 8, 2022	23	737	427	58.0%	Thursday, July 28, 2022	18	412	55.9%
Aug-22	301,869	Sunday, August 21, 2022	21	579	406	70.1%	Monday, August 8, 2022	18	376	65.0%
Sep-22	316,946	Monday, September 19, 2022	22	706	440	62.4%	Thursday, September 1, 2022	18	440	62.3%
Oct-22	423,998	Monday, October 31, 2022	22	878	570	64.9%	Tuesday, October 25, 2022	19	809	92.1%
Nov-22	826,474	Monday, November 28, 2022	24	2,630	1,148	43.6%	Tuesday, November 29, 2022	18	1,131	43.0%
Dec-22	1,085,732	Thursday, December 22, 2022	21	3,096	1,459	47.1%	Thursday, December 22, 2022	18	2,598	83.9%
Jan-23	1,005,957	Friday, January 6, 2023	24	2,093	1,352	64.6%	Monday, January 30, 2023	9	1,510	72.2%
Feb-23	943,952	Thursday, February 16, 2023	22	2,356	1,405	59.6%	Friday, February 24, 2023	8	1,523	64.6%
Mar-23	870,091	Saturday, March 4, 2023	23	1,923	1,169	60.8%	Wednesday, March 1, 2023	8	1,759	91.5%
Apr-23	562,798	Saturday, April 22, 2023	23	1,243	782	62.9%	Monday, April 3, 2023	9	936	75.3%
May-23	336,012	Monday, May 1, 2023	22	1,035	452	43.6%	Monday, May 15, 2023	18	299	28.9%
Jun-23	270,734	Friday, June 16, 2023	22	544	376	69.1%	Wednesday, June 7, 2023	19	267	49.1%
Annual	7,262,431	Annual Class Peak		3,096	829	26.8%	Annual System CP		2,598	83.9%
		Average 12 Monthly NCPs		1,485		55.8%	Average 12 Monthly CPs		1,005	67.7%
		Average Top 12 NCPs		2,697		30.7%	Average Top 12 CPs		1,807	67.0%
		Average Top 75 NCPs		2,111		39.3%	Average Top 75 CPs		1,647	78.0%
		Average Top 200 NCPs		1,898		43.7%	Average Top 200 CPs		1,564	82.4%
							Average 4CPs *		1,690	

Table 9 – Schedule 05 Class: Summary Statistics (Totals – kW)

Table 10 presents the data on an average-per-customer basis. For Schedule 05, the average annual use per account is 907,804 kWh with average annual peak demand of 386.96 kW.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Timing of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	39,734	Friday, July 8, 2022	23	92.09	53.41	58.0%	Thursday, July 28, 2022	18	51.45	55.9%
Aug-22	37,734	Sunday, August 21, 2022	21	72.34	50.72	70.1%	Monday, August 8, 2022	18	47.05	65.0%
Sep-22	39,618	Monday, September 19, 2022	22	88.24	55.03	62.4%	Thursday, September 1, 2022	18	54.97	62.3%
Oct-22	53,000	Monday, October 31, 2022	22	109.74	71.24	64.9%	Tuesday, October 25, 2022	19	101.10	92.1%
Nov-22	103,309	Monday, November 28, 2022	24	328.81	143.49	43.6%	Tuesday, November 29, 2022	18	141.36	43.0%
Dec-22	135,716	Thursday, December 22, 2022	21	386.96	182.41	47.1%	Thursday, December 22, 2022	18	324.79	83.9%
Jan-23	125,745	Friday, January 6, 2023	24	261.59	169.01	64.6%	Monday, January 30, 2023	9	188.75	72.2%
Feb-23	117,994	Thursday, February 16, 2023	22	294.50	175.59	59.6%	Friday, February 24, 2023	8	190.31	64.6%
Mar-23	108,761	Saturday, March 4, 2023	23	240.40	146.18	60.8%	Wednesday, March 1, 2023	8	219.89	91.5%
Apr-23	70,350	Saturday, April 22, 2023	23	155.38	97.71	62.9%	Monday, April 3, 2023	9	117.03	75.3%
May-23	42,001	Monday, May 1, 2023	22	129.41	56.45	43.6%	Monday, May 15, 2023	18	37.42	28.9%
Jun-23	33,842	Friday, June 16, 2023	22	68.06	47.00	69.1%	Wednesday, June 7, 2023	19	33.44	49.1%
Annual	907,804	Annual Class Peak		386.96	103.63	26.8%	Annual System CP		324.79	83.9%

Table 10 – Schedule 05 Customer: Summary Statistics (Means – kW)

3.4 Schedules 8 & 24 Small General Service

For small general service non-net meter commercial class, all available data were used and hence no post-stratification was done to this data. For commercial net-meter customers, about 39% of the population data were available and for Industrial non-net meter, about 60%; and for net meter classes, about 67% of the data were available. For these classes, the sample data were expanded by post-stratification. Table 11 presents the post-stratification used in the sample expansion analysis for commercial net-meter class and Industrial net-meter and non-net meter classes. The table shows population count, number of sample points and the case weight by annual energy usage bracket. The stratification is done separately for each type of customer, net meter, non-net meter types as well as by Commercial and Industrial customers. For net meter customers, the delivered energy was used as the stratification variable.

Maximum kWh	N(h)	n(h)	Case Weights
Commercial Net Meter Customers (Forward and Reverse Channels)			
18,615	547	210	2.60
39,055	166	63	2.63
78,475	90	41	2.20
169,725	52	18	2.89
1,184,060	20	9	2.22
Total	875	341	12.55
Indistrial Non-Net Meter Customers			
17,885	1,684	926	1.82
35,040	558	375	1.49
62,415	347	220	1.58
104,025	230	156	1.47
871,255	128	84	1.52
Total	2,947	1,761	7.88
Industrial Net Meter Customers (Forward and Reverse Channels)			
150,015	3	2	1.50
Total	3	2	2

Table 11 – Schedules 8 & 24: Post-Stratification

In the next step, the average loss factor estimated for Schedules 8 & 24 was applied to the hourly expansions to produce the class hourly load profile with losses. As shown in Table 4, the average loss factor estimated for the Small General Service class is 10.08%.

The hourly load estimates including line losses were preliminary estimates of the Small General Service class' contribution to system's hourly demand. In the final stage of the analysis, the unaccounted for energy (UFE) was allocated to the Schedules 8 & 24 based on preliminary percentage estimate of its contribution to the system demand for that particular hour.

Figure 11 presents the Schedules 8 & 24 class load. The figure displays the EnergyPrint to the left of a two-dimensional x-y plot. The figure shows dominance of early morning winter load. The Small General Service class peak occurred on the system peak day, December 22 at 11 AM. The peak demand was about 616.7 MW.

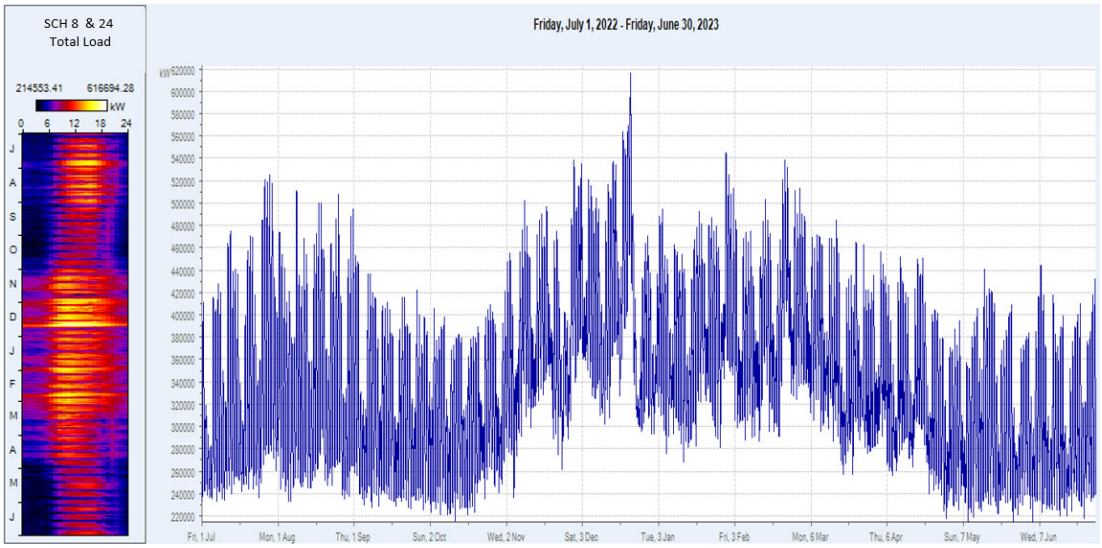

Figure 11 – Schedules 8 & 24: Class Total Load

Figure 12 presents the Small General Service class load during the system peak week of Sunday, December 18, 2022 through Saturday, December 24, 2022. The Small General Service class peak coincides with the system peak day with a coincidence factor or 89.4%.

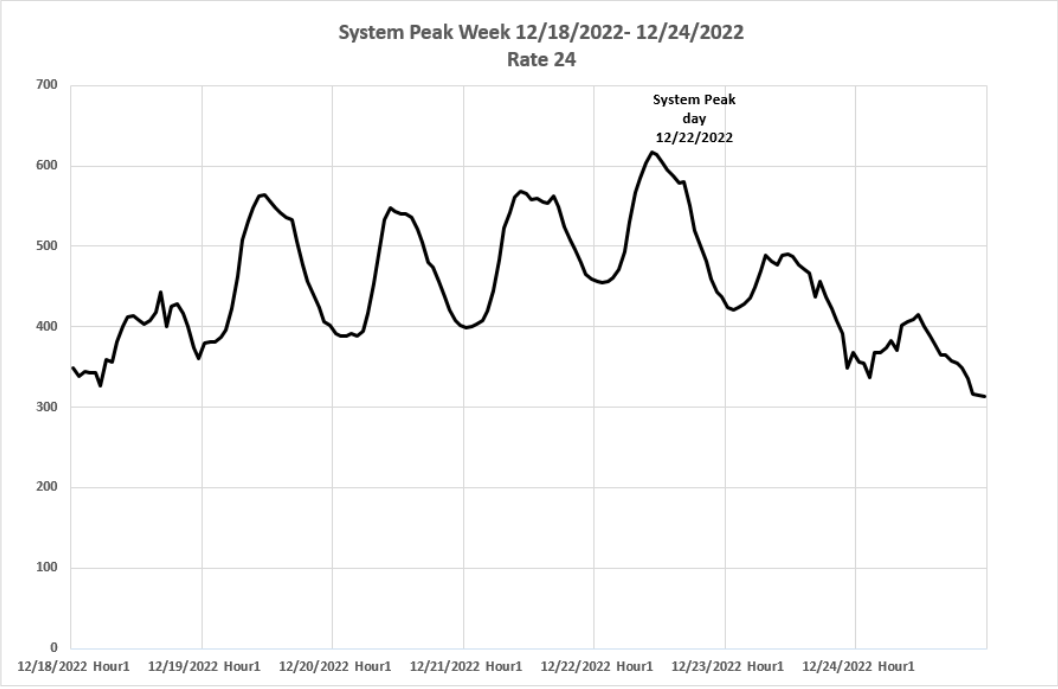

Figure 12 – Schedules 8 & 24: Total Load during System Peak Week

Figure 13 presents the monthly Small General Service class energy consumption, peak demand and load factor in graphics.

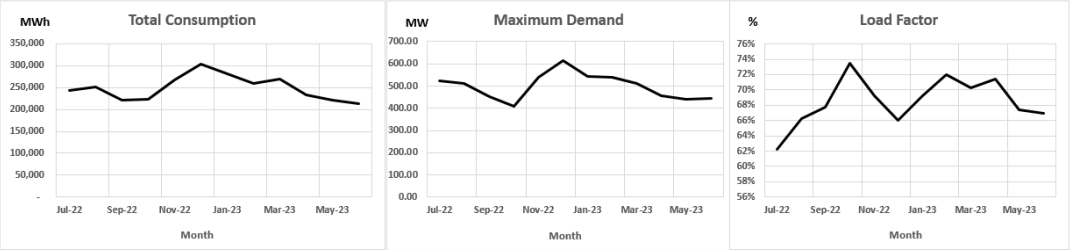

Figure 13 – Schedules 8 & 24: Class Monthly Energy, Demand and Load Factor

Achieved precision associated with the Small General Service class analysis can be evaluated in terms of the deviation of the annual sum of estimated class hourly loads net of losses from the total actual sales to the class in the same period. The sum of estimated hourly loads net of losses was 2,689,120 MWh, 3.84% lower than the actual class sales of 2,796,488 MWh.

Table 12 presents summary statistics for the Schedules 8 & 24 total class load. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-month average coincident peak contributions, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. Monthly NCP load factors range from a low of 62.2% in July, 2022 to a high of 73.5% in October, 2022. The coincidence factors for Schedules 8 & 24 are over 90% for six out of twelve months and over 80% for all twelve months.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	242,958,845	Thursday, July 28, 2022	15	525,106	326,558	62.2%	Thursday, July 28, 2022	18	480,784	91.6%
Aug-22	251,824,925	Monday, August 8, 2022	14	510,558	338,474	66.3%	Monday, August 8, 2022	18	447,962	87.7%
Sep-22	221,010,056	Thursday, September 1, 2022	16	452,918	306,958	67.8%	Thursday, September 1, 2022	18	416,097	91.9%
Oct-22	223,524,664	Wednesday, October 26, 2022	11	408,893	300,436	73.5%	Tuesday, October 25, 2022	19	356,318	87.1%
Nov-22	268,468,667	Tuesday, November 29, 2022	11	538,674	372,873	69.2%	Tuesday, November 29, 2022	18	479,177	89.0%
Dec-22	303,132,276	Thursday, December 22, 2022	11	616,694	407,436	66.1%	Thursday, December 22, 2022	18	551,140	89.4%
Jan-23	281,063,897	Monday, January 30, 2023	10	545,317	377,774	69.3%	Monday, January 30, 2023	9	535,976	98.3%
Feb-23	260,531,081	Thursday, February 23, 2023	11	538,322	387,695	72.0%	Friday, February 24, 2023	8	517,072	96.1%
Mar-23	268,647,732	Wednesday, March 1, 2023	10	513,584	361,086	70.3%	Wednesday, March 1, 2023	8	478,752	93.2%
Apr-23	234,448,573	Monday, April 3, 2023	11	456,057	325,623	71.4%	Monday, April 3, 2023	9	439,416	96.4%
May-23	220,821,979	Monday, May 15, 2023	15	440,380	296,804	67.4%	Monday, May 15, 2023	18	395,981	89.9%
Jun-23	214,136,440	Wednesday, June 7, 2023	15	444,074	297,412	67.0%	Wednesday, June 7, 2023	19	376,599	84.8%
Annual	2,990,569,135	Annual Class Peak		616,694	341,389	55.4%	Annual System CP		551,140	89.4%
		Average 12 Monthly NCPs		499,215		68.4%	Average 12 Monthly CPs		456,273	91.4%
		Average Top 12 NCPs		588,910		58.0%	Average Top 12 CPs		568,525	96.5%
		Average Top 75 NCPs		544,458		62.7%	Average Top 75 CPs		522,950	96.0%
		Average Top 200 NCPs		519,332		65.7%	Average Top 200 CPs		494,074	95.1%
							Average 4CPs *		520,841	

* Monthly CPs for November, December, January and February

Table 12 – Schedules 8 & 24 Class: Summary Statistics (Totals – kW)

Table 13 presents the data on an average-per-customer basis. For Schedules 8 & 24, the average annual use per customer is 23,777 kWh with annual average peak demand of 4.90 kW.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Timing of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	1,932	Thursday, July 28, 2022	15	4.18	2.60	62.2%	Thursday, July 28, 2022	18	3.82	91.6%
Aug-22	2,002	Monday, August 8, 2022	14	4.06	2.69	66.3%	Monday, August 8, 2022	18	3.56	87.7%
Sep-22	1,758	Thursday, September 1, 2022	16	3.60	2.44	67.8%	Thursday, September 1, 2022	18	3.31	91.9%
Oct-22	1,780	Wednesday, October 26, 2022	11	3.26	2.39	73.5%	Tuesday, October 25, 2022	19	2.84	87.1%
Nov-22	2,135	Tuesday, November 29, 2022	11	4.28	2.96	69.2%	Tuesday, November 29, 2022	18	3.81	89.0%
Dec-22	2,410	Thursday, December 22, 2022	11	4.90	3.24	66.1%	Thursday, December 22, 2022	18	4.38	89.4%
Jan-23	2,237	Monday, January 30, 2023	10	4.34	3.01	69.3%	Monday, January 30, 2023	9	4.27	98.3%
Feb-23	2,073	Thursday, February 23, 2023	11	4.28	3.08	72.0%	Friday, February 24, 2023	8	4.11	96.1%
Mar-23	2,136	Wednesday, March 1, 2023	10	4.08	2.87	70.3%	Wednesday, March 1, 2023	8	3.81	93.2%
Apr-23	1,862	Monday, April 3, 2023	11	3.62	2.59	71.4%	Monday, April 3, 2023	9	3.49	96.4%
May-23	1,754	Monday, May 15, 2023	15	3.50	2.36	67.4%	Monday, May 15, 2023	18	3.14	89.9%
Jun-23	1,699	Wednesday, June 7, 2023	15	3.52	2.36	67.0%	Wednesday, June 7, 2023	19	2.99	84.8%
Annual	23,777	Annual Class Peak		4.90	2.71	55.4%	Annual System CP		4.38	89.4%

Table 13 – Schedules 8 & 24 Customer: Summary Statistics (Means – kW)

3.5 Schedules 11 & 25 Medium General Service

For medium general service, commercial net meter class had interval data for 53% of the population, commercial non-net meter had 47% and Industrial non-net meter had 50% population coverage. The class profiles are developed using sample expansion analyses, since 50% or more customers' interval data were not available. Table 14 presents the post-stratification used in the sample expansion analysis. The table shows population count, number of sample points and the case weight by annual energy usage bracket. The stratification is done separately for Commercial non net-meter, commercial net meter and Industrial customers types.

Maximum kWh	N(h)	n(h)	Case Weights
Commercial Customer non-net meter			
228,855	3,616	1,890	1.91
370,475	1,817	816	2.23
575,240	1,265	354	3.57
967,615	875	402	2.18
6,532,770	496	306	1.62
Total	8,069	3,768	11.51
Commercial Customer net-meter			
262,800	37	20	1.85
884,395	16	8	2.00
Total	53	28	3.85
Industrial Customer			
193,815	220	116	1.90
338,355	102	53	1.92
508,445	70	27	2.59
860,305	49	31	1.58
1,854,930	31	24	1.29
Total	472	251	9.29

Table 14 – Schedules 11 & 25: Post-Stratification

In the next step, the average loss factor estimated for the Medium General Service class was applied to the hourly expansions to produce the class hourly load profile with losses. As listed in Table 4, the estimated average loss factor for Schedules 11 & 25 is 10.04%. In the final step, the unaccounted for energy (UFE) was allocated to the Schedules 11 & 25 based on preliminary percentage estimate of its contribution to the system demand for that particular hour.

Figure 14 presents the total load for Schedules 11 & 25. The figure displays the EnergyPrint to the left of a two-dimensional x-y plot. Due to space heating and cooling loads, the Schedules 11 & 25 load profile shows that its mid-winter and mid-summer loads tend to be higher than other seasonal loads. The Schedules 11 & 25 class load peaked on Thursday, December 22 at 11 AM. The class peak demand was 605 MW.

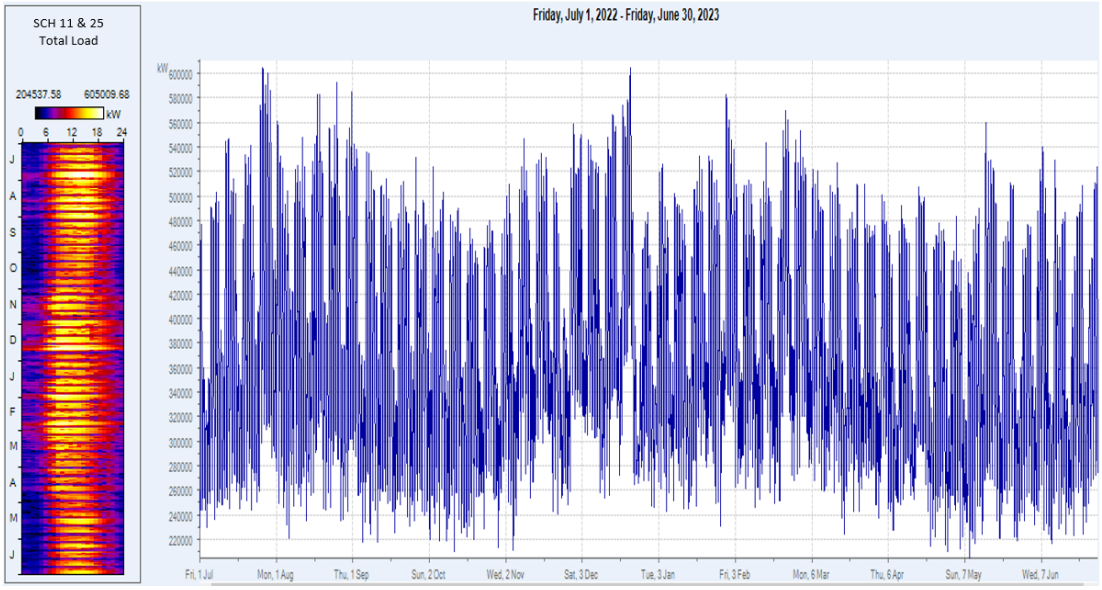

Figure 14 – Schedules 11 & 25: Class Total Load

Figure 15 presents the Schedules 11 & 25 class load during the system peak week of Sunday, December 22, 2022 through Saturday, December 24, 2022. For this rate class, class peak occurs same day as the system peak day but at a different hour.

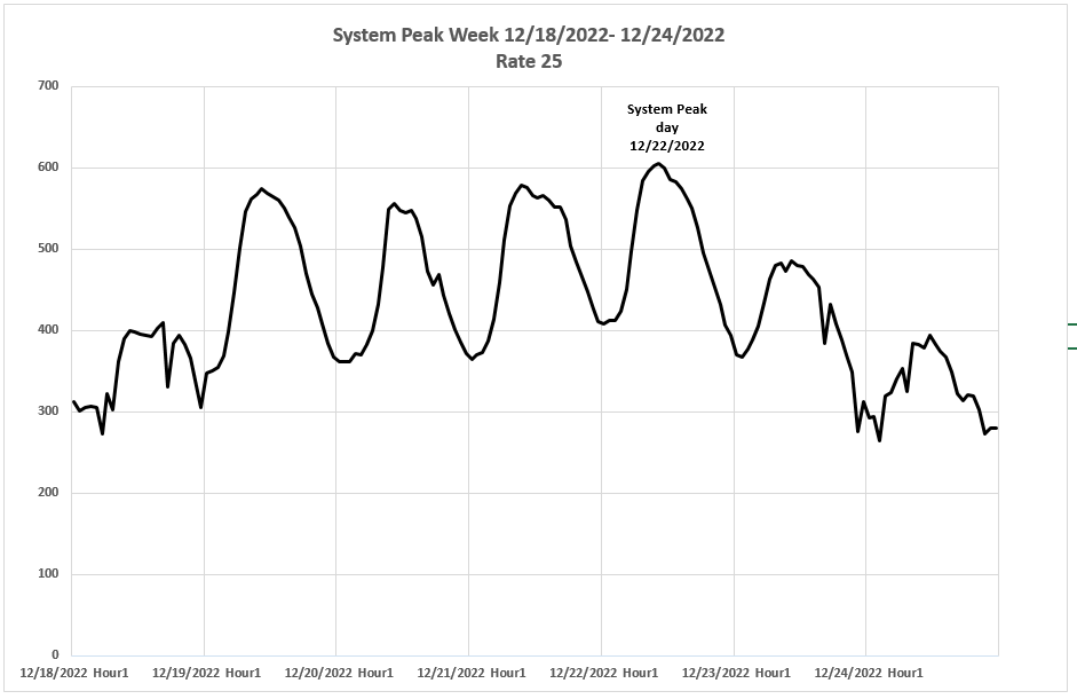

Figure 15 – Schedules 11 & 25: Total Load during System Peak Week

Figure 16 presents the monthly Medium General Service class energy consumption, peak demand and load factor in graphics. The monthly peak loads in December and July were winter and summer seasonal peak loads.

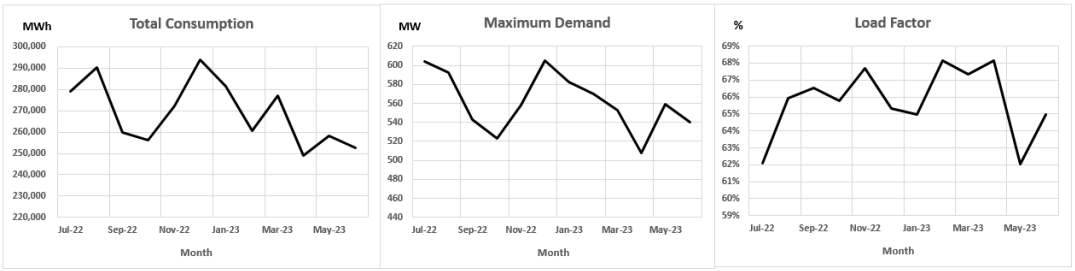

Figure 16 – Schedules 11 & 25: Class Monthly Energy, Demand and Load Factor

Achieved precision associated with the Medium General Service class analysis is evaluated in terms of the deviation of the annual sum of the class hourly loads net of losses estimated for the study period from the total actual sales to the class during the same period. The sum of estimated hourly loads net of losses was 2,906,630 MWh, 3.97% lower than the actual class sales of 3,026,718 MWh. The percentage of error is much less than the maximum error margin of ±10% tolerated in a typical load research practice.

Table 15 presents summary statistics for the Schedules 11 & 25 class load. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-month average coincident peak contributions, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. Monthly NCP load factors varies from a low of 62.1% to a high of 68.2% in April, 2023. Monthly system coincidence factor of Schedule 11 & 25 load fluctuates form 77.1% in October, 2022 to 100% in January, 2023.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	279,016,462	Tuesday, July 26, 2022	14	604,144	375,022	62.1%	Thursday, July 28, 2022	18	550,345	91.1%
Aug-22	290,479,296	Thursday, August 25, 2022	15	592,358	390,429	65.9%	Monday, August 8, 2022	18	515,866	87.1%
Sep-22	259,949,209	Thursday, September 1, 2022	15	542,633	361,041	66.5%	Thursday, September 1, 2022	18	496,816	91.6%
Oct-22	256,156,142	Monday, October 3, 2022	15	523,445	344,296	65.8%	Tuesday, October 25, 2022	19	403,545	77.1%
Nov-22	272,320,845	Tuesday, November 29, 2022	10	558,610	378,223	67.7%	Tuesday, November 29, 2022	18	481,796	86.2%
Dec-22	294,107,714	Thursday, December 22, 2022	11	605,010	395,306	65.3%	Thursday, December 22, 2022	18	526,314	87.0%
Jan-23	281,454,173	Monday, January 30, 2023	9	582,367	378,299	65.0%	Monday, January 30, 2023	9	582,367	100.0%
Feb-23	260,746,990	Thursday, February 23, 2023	10	569,526	388,016	68.1%	Friday, February 24, 2023	8	549,980	96.6%
Mar-23	276,923,563	Wednesday, March 1, 2023	10	552,812	372,209	67.3%	Wednesday, March 1, 2023	8	532,235	96.3%
Apr-23	249,013,811	Tuesday, April 18, 2023	10	507,419	345,853	68.2%	Monday, April 3, 2023	9	498,057	98.2%
May-23	258,232,385	Monday, May 15, 2023	14	559,213	347,087	62.1%	Monday, May 15, 2023	18	487,155	87.1%
Jun-23	252,624,522	Wednesday, June 7, 2023	14	539,909	350,867	65.0%	Wednesday, June 7, 2023	19	457,826	84.8%
Annual	3,231,025,113	Annual Class Peak		605,010	368,838	61.0%	Annual System CP		526,314	87.0%
		Average 12 Monthly NCPs		561,454		65.7%	Average 12 Monthly CPs		506,859	90.3%
		Average Top 12 NCPs		598,381		61.6%	Average Top 12 CPs		555,765	92.9%
		Average Top 75 NCPs		579,241		63.7%	Average Top 75 CPs		521,780	90.1%
		Average Top 200 NCPs		560,026		65.9%	Average Top 200 CPs		498,704	89.1%
							Average 4CPs *		535,114	

* Monthly CPs for November, December, January and February

Table 15 – Schedules 11 & 25 Class: Summary Statistics (Totals – kW)

Table 16 presents the data on an average-per-customer basis. For Schedule 25, the average annual use per customer is 390 MWh with annual average peak demand of 74.16 kW.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Timing of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	34,699	Tuesday, July 26, 2022	14	75.13	46.64	62.1%	Thursday, July 28, 2022	18	68.44	91.1%
Aug-22	36,125	Thursday, August 25, 2022	15	73.67	48.55	65.9%	Monday, August 8, 2022	18	64.15	87.1%
Sep-22	32,324	Thursday, September 1, 2022	15	67.47	44.89	66.5%	Thursday, September 1, 2022	18	61.78	91.6%
Oct-22	31,773	Monday, October 3, 2022	15	64.93	42.71	65.8%	Tuesday, October 25, 2022	19	50.06	77.1%
Nov-22	33,678	Tuesday, November 29, 2022	10	69.08	46.78	67.7%	Tuesday, November 29, 2022	18	59.58	86.2%
Dec-22	36,359	Thursday, December 22, 2022	11	74.79	48.87	65.3%	Thursday, December 22, 2022	18	65.07	87.0%
Jan-23	34,483	Monday, January 30, 2023	9	71.35	46.35	65.0%	Monday, January 30, 2023	9	71.35	100.0%
Feb-23	31,814	Thursday, February 23, 2023	10	69.49	47.34	68.1%	Friday, February 24, 2023	8	67.10	96.6%
Mar-23	33,652	Wednesday, March 1, 2023	10	67.18	45.23	67.3%	Wednesday, March 1, 2023	8	64.68	96.3%
Apr-23	30,074	Tuesday, April 18, 2023	10	61.28	41.77	68.2%	Monday, April 3, 2023	9	60.15	98.2%
May-23	31,030	Monday, May 15, 2023	14	67.20	41.71	62.1%	Monday, May 15, 2023	18	58.54	87.1%
Jun-23	30,273	Wednesday, June 7, 2023	14	64.70	42.05	65.0%	Wednesday, June 7, 2023	19	54.86	84.8%
Annual	396,060	Annual Class Peak		74.16	45.21	61.0%	Annual System CP		64.52	87.0%

Table 16 – Schedules 11 & 25 Customer: Summary Statistics (Means – kW)

3.6 Schedules 12 & 26 Large General Service

For Large General Service class, about 64% of the population had interval data, therefore the sample interval data available for analyses were expanded by post-stratifying for Schedules 12 & 26. The

net-meter profiles for schedule 26 were not estimated due to unavailability of sufficient data. Table 17 presents the post-stratification used in the sample expansion analysis for both commercial and industrial customers. The table shows population count, number of sample points and the case weight by annual energy usage bracket.

Maximum kWh	N(h)	n(h)	Case Weights
Commercial Customers			
1,476,060	301	172	1.75
2,077,580	175	119	1.47
2,723,265	140	96	1.46
3,580,650	111	70	1.59
14,400,345	77	58	1.33
Total	804	515	7.59
Industrial Customer			
1,241,365	39	23	1.70
1,923,185	20	16	1.25
2,903,940	14	7	2.00
4,425,990	11	9	1.22
8,689,920	7	4	1.75
Total	91	59	7.92

Table 17 – Schedules 12 & 26: Post-Stratification

In the second step, the average loss factor estimated for Schedules 12 & 26 was applied to the hourly expansions to produce the class hourly load profile with losses. As seen in Table 4, the estimated average loss factor for the Large General Service class is 10.03%. In the final step, the unaccounted for energy (UFE) was allocated to the Schedules 12 & 26 based on preliminary percentage estimate of its contribution to the system demand for that particular hour.

Figure 17 presents the total load for the Schedules 12 & 26 class. The figure displays the EnergyPrint to the left of a two-dimensional x-y plot. The Schedules 12 & 26 class load shows comparatively higher in the day time during summer months. The Large General Service class load peaked on Tuesday, August 30, 2022 at 3 PM. The class peak demand was 347.6 MW.

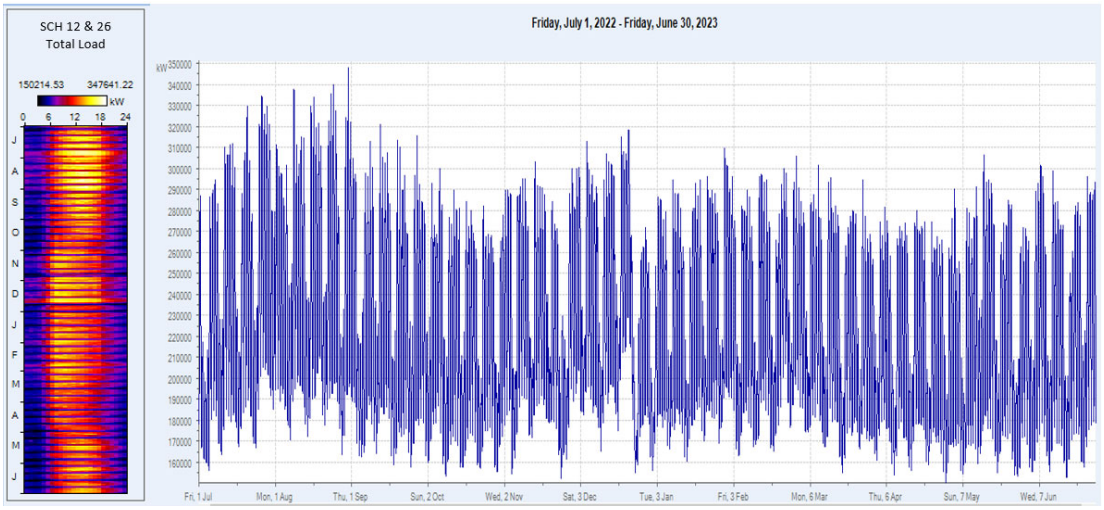

Figure 17 – Schedules 12 & 26: Class Total Load

Figure 18 presents the Schedule 12 & 26 class loads during the system peak week of Sunday, December 18, 2022 through Saturday, December 24, 2022. At the system peak day and hour, the class demand was 283.5 MW, or 89% of the class peak demand of 347.6 MW.

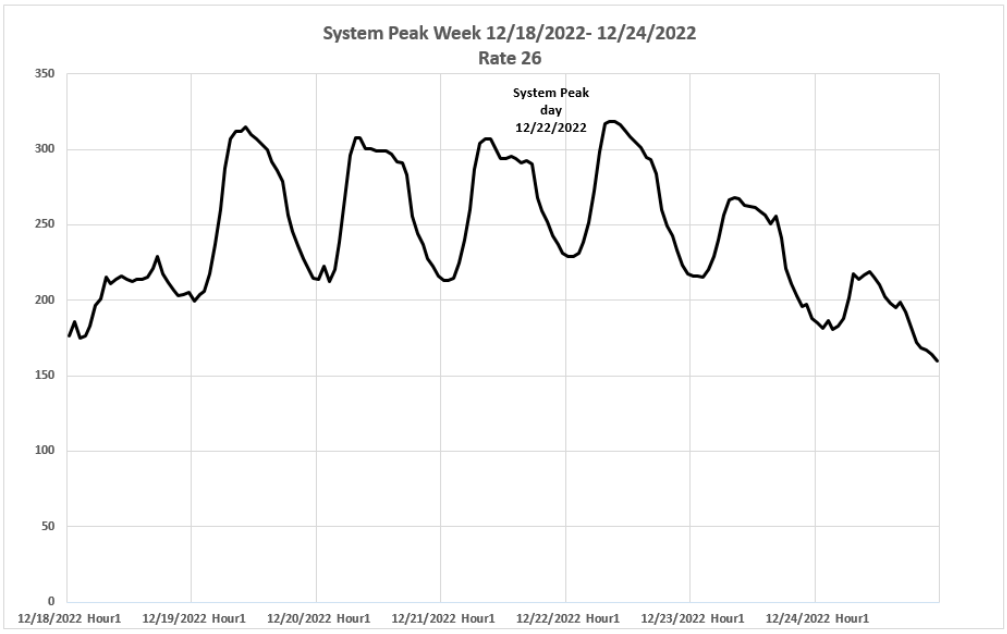

Figure 18 – Schedules 12 & 26: Total Load during System Peak Week

Figure 19 presents monthly Schedules 12 & 26 class energy consumption, peak demand and load factor in graphics. The total consumptions shows variability across months however peak hourly demands are primarily in the peak summer months.

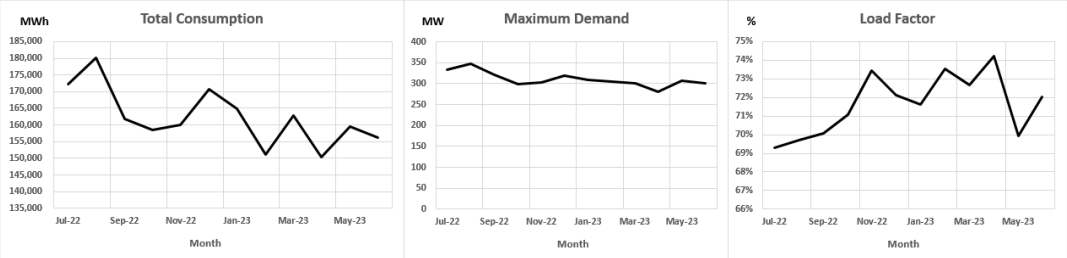

Figure 19 –Schedules 12 & 26: Class Monthly Energy, Demand and Load Factor

Achieved precision of the Large General Service class analysis is evaluated in terms of the deviation of the sum of the estimated class hourly loads net of losses from the total actual sales to the class during the 12-month study period. The sum of estimated hourly loads net of losses was 1,753,389 MWh, 3.85% lower than the actual class sales of 1,823,650 MWh. The percentage of error is much less than the maximum tolerable error margin of ±10% set for a typical load research practice.

Table 18 presents summary statistics for the Schedules 12 & 26 class load. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-month average coincident peak contributions, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. Monthly NCP load factors fluctuate with a low of 69.3% in July, 2022 and a high of 74.2% in April, 2023. The Schedules 12 & 26 load is fairly coincident with the system peak displaying a system peak coincidence factor of over 80% for eleven out of the 12 months.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	172,248,375	Tuesday, July 26, 2022	14	334,154	231,517	69.3%	Thursday, July 28, 2022	18	315,537	94.4%
Aug-22	180,251,479	Tuesday, August 30, 2022	15	347,641	242,273	69.7%	Monday, August 8, 2022	18	298,894	86.0%
Sep-22	161,786,579	Monday, September 12, 2022	14	320,729	224,704	70.1%	Thursday, September 1, 2022	18	283,586	88.4%
Oct-22	158,580,710	Thursday, October 06, 2022	16	299,807	213,146	71.1%	Tuesday, October 25, 2022	19	224,237	74.8%
Nov-22	160,139,354	Monday, November 14, 2022	8	302,796	222,416	73.5%	Tuesday, November 29, 2022	18	265,480	87.7%
Dec-22	170,835,937	Thursday, December 22, 2022	9	318,401	229,618	72.1%	Thursday, December 22, 2022	18	283,530	89.0%
Jan-23	164,808,431	Monday, January 30, 2023	9	309,339	221,517	71.6%	Monday, January 30, 2023	9	309,339	100.0%
Feb-23	151,073,504	Tuesday, February 28, 2023	10	305,742	224,812	73.5%	Friday, February 24, 2023	8	297,731	97.4%
Mar-23	162,942,321	Thursday, March 09, 2023	10	301,282	219,008	72.7%	Wednesday, March 1, 2023	8	288,461	95.7%
Apr-23	150,454,764	Wednesday, April 05, 2023	e8	281,464	208,965	74.2%	Monday, April 3, 2023	9	274,390	97.5%
May-23	159,447,507	Monday, May 15, 2023	14	306,441	214,311	69.9%	Monday, May 15, 2023	18	279,348	91.2%
Jun-23	156,291,106	Wednesday, June 07, 2023	14	301,402	217,071	72.0%	Wednesday, June 7, 2023	19	254,205	84.3%
Annual	1,948,860,068	Annual Class Peak		347,641	222,473	64.0%	Annual System CP		283,530	81.6%
		Average 12 Monthly NCPs		310,767		71.6%	Average 12 Monthly CPs		281,228	90.5%
		Average Top 12 NCPs		336,452		66.1%	Average Top 12 CPs		295,323	87.8%
		Average Top 75 NCPs		324,809		68.5%	Average Top 75 CPs		283,846	87.4%
		Average Top 200 NCPs		315,211		70.6%	Average Top 200 CPs		275,009	87.2%
							Average 4CPs *		289,020	

* Monthly CPs for November, December, January and February

Table 18 – Schedules 12 & 26 Class: Summary Statistics (Totals –kW)

Table 19 presents the data on an average-per-customer basis. For Schedules 12 & 26, the average annual use per customer is 2,283 MWh with annual average peak demand of 407.27 kW.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Timing of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	206,533	Tuesday, July 26, 2022	14	400.66	277.60	69.3%	Thursday, July 28, 2022	18	378.34	94.4%
Aug-22	216,388	Tuesday, August 30, 2022	15	417.34	290.84	69.7%	Monday, August 8, 2022	18	358.82	86.0%
Sep-22	194,222	Monday, September 12, 2022	14	385.03	269.75	70.1%	Thursday, September 1, 2022	18	340.44	88.4%
Oct-22	189,690	Thursday, October 6, 2022	16	358.62	254.96	71.1%	Tuesday, October 25, 2022	19	268.23	74.8%
Nov-22	191,554	Monday, November 14, 2022	8	362.20	266.05	73.5%	Tuesday, November 29, 2022	18	317.56	87.7%
Dec-22	204,349	Thursday, December 22, 2022	9	380.86	274.66	72.1%	Thursday, December 22, 2022	18	339.15	89.0%
Jan-23	192,758	Monday, January 30, 2023	9	361.80	259.08	71.6%	Monday, January 30, 2023	9	361.80	100.0%
Feb-23	175,056	Tuesday, February 28, 2023	10	354.28	260.50	73.5%	Friday, February 24, 2023	8	345.00	97.4%
Mar-23	188,155	Thursday, March 9, 2023	10	347.90	252.90	72.7%	Wednesday, March 1, 2023	8	333.10	95.7%
Apr-23	171,361	Wednesday, April 5, 2023	e8	320.57	238.00	74.2%	Monday, April 3, 2023	9	312.52	97.5%
May-23	180,779	Monday, May 15, 2023	14	347.44	242.98	69.9%	Monday, May 15, 2023	18	316.72	91.2%
Jun-23	175,411	Wednesday, June 7, 2023	14	338.27	243.63	72.0%	Wednesday, June 7, 2023	19	285.30	84.3%
Annual	2,283,152	Annual Class Peak		407.27	260.63	64.0%	Annual System CP		332.16	81.6%

Table 19 – Schedules 12 & 26 Customer: Summary Statistics (Means – kW)

3.7 Schedule 29 Seasonal Irrigation

For Schedule 29, about 32% of the customers have interval load data, therefore the class profiles were developed by post-stratifying the data available for Schedule 29 Seasonal Irrigation and Pumping Service class. Table 20 presents the post-stratification used in the sample expansion analysis.

Maximum kWh	N(h)	n(h)	Case Weights
All Customer			
17,885	445	132	3.37
31,025	130	42	3.10
54,750	85	33	2.58
93,075	56	21	2.67
577,430	30	9	3.33
Total	746	237	15.04

Table 20 – Schedule 29: Post-Stratification

In the next step, the average loss factor estimated for Schedule 29 was applied to the hourly expansions to produce the class hourly load profile. Table 4 indicates that the estimated average loss factor for the irrigation rate schedule is 9.95%. In the final step, the unaccounted for energy (UFE) was allocated to the Schedule 29 in proportion to preliminary estimate of its contribution to the system demand for hour by hour.

Figure 20 presents the total load for the Seasonal Irrigation and Pumping Service class. The figure displays the EnergyPrint to the left of a two-dimensional x-y plot. Dominance of the summer seasonal load is clearly evident. The Seasonal Irrigation and Pumping Service class peak occurred on Thursday, July 28, 2022 at 3 PM. The class peak demand was 6.1 MW.

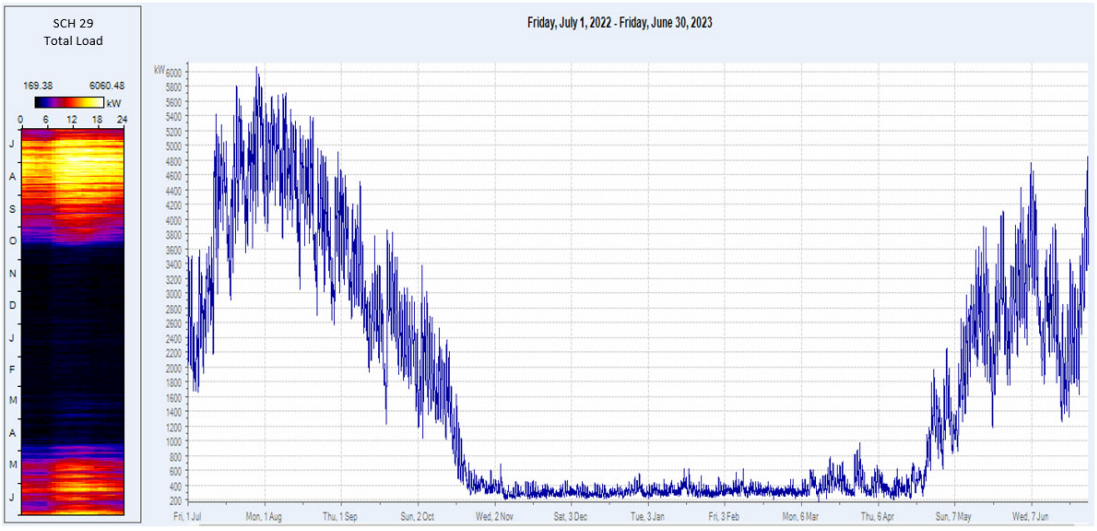

Figure 20 – Schedule 29: Class Total Load

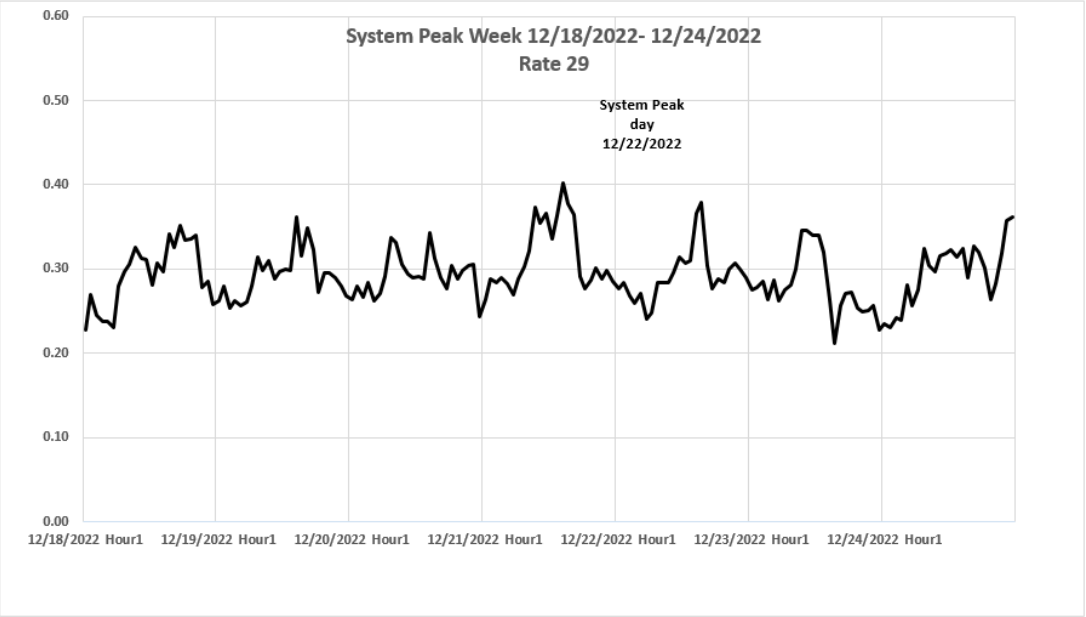

Figure 21 presents the total Seasonal Irrigation Rate Schedule 29 loads during the system peak week of Sunday, December 18, 2022 through Saturday, December 24, 2022. The system peaked on Thursday, December 22 at 6 PM. The class had a system peak hour load of about 276 kW or 4.6% of its July peak of 6.1 MW.

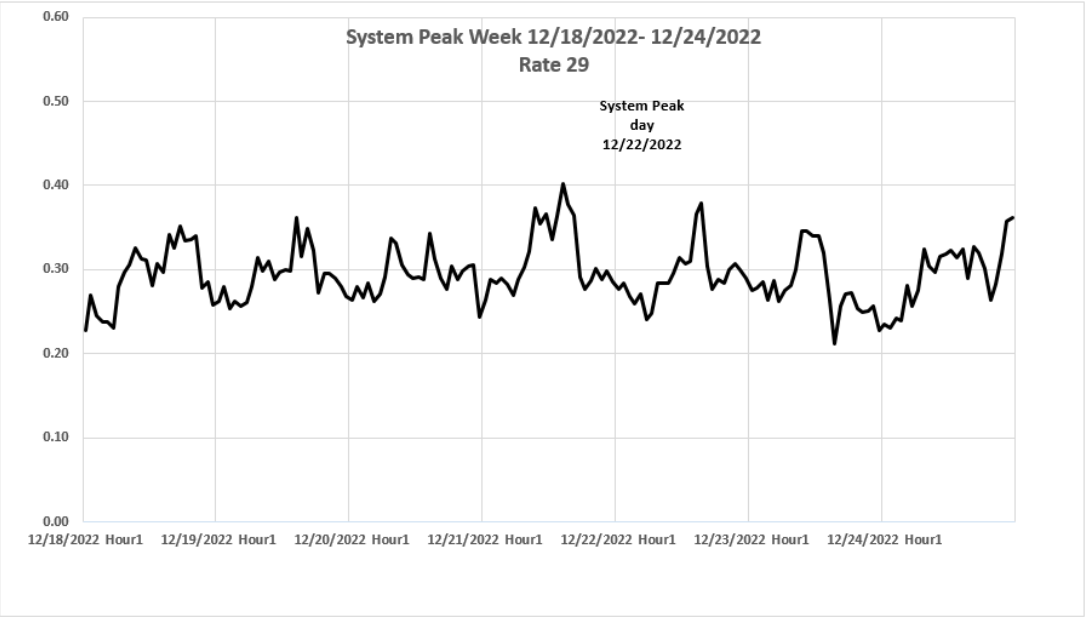

Figure 21 – Schedule 29: Total Load during System Peak Week

Figure 22 shows the monthly Schedule 29 class energy consumption, peak demand and load factor in graphics. The Seasonal Irrigation and Pumping Service load is highest during the summer months.

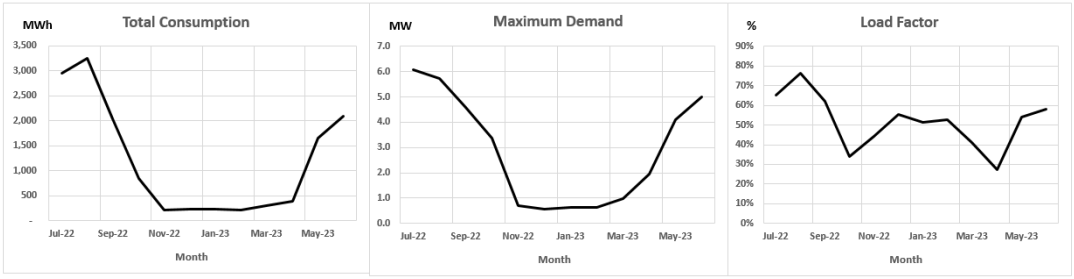

Figure 22 –Schedule 29: Class Monthly Energy, Demand and Load Factor

For Schedule 29, the sum of estimated hourly loads net of losses for the 12 months ending June 2023 was 13,007 MWh, 4.16% lower than the actual class sales of 13,571.8 MWh. The error margin is again below the tolerated threshold.

Table 21 presents summary statistics for the Seasonal Irrigation and Pumping Service load. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-month average coincident peak contributions, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. Monthly load factors range from a low of 27.5% in April, 2022 to a high of 76.4% in August, 2022. Seasonal Irrigation load is highly coincident with the system peak during the months of May, June, July, August, and September with a coincidence factor over 85% in each of these months.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	2,947,726	Thursday, July 28, 2022	15	6,060	3,962	65.4%	Thursday, July 28, 2022	18	5,613	92.6%
Aug-22	3,245,131	Tuesday, August 9, 2022	12	5,713	4,362	76.4%	Monday, August 8, 2022	18	5,624	98.5%
Sep-22	2,044,700	Friday, September 2, 2022	11	4,581	2,840	62.0%	Thursday, September 1, 2022	18	4,344	94.8%
Oct-22	853,291	Monday, October 3, 2022	15	3,373	1,147	34.0%	Tuesday, October 25, 2022	19	343	10.2%
Nov-22	219,764	Friday, November 4, 2022	10	687	305	44.4%	Tuesday, November 29, 2022	18	298	43.4%
Dec-22	228,742	Friday, December 30, 2022	8	555	307	55.4%	Thursday, December 22, 2022	18	276	49.8%
Jan-23	239,546	Thursday, January 19, 2023	12	624	322	51.6%	Monday, January 30, 2023	9	364	58.4%
Feb-23	220,664	Friday, February 10, 2023	10	620	328	52.9%	Friday, February 24, 2023	8	342	55.2%
Mar-23	299,241	Wednesday, March 29, 2023	16	975	402	41.2%	Wednesday, March 1, 2023	8	323	33.1%
Apr-23	390,094	Friday, April 28, 2023	12	1,967	542	27.5%	Monday, April 3, 2023	9	379	19.3%
May-23	1,658,241	Friday, May 26, 2023	14	4,112	2,229	54.2%	Monday, May 15, 2023	18	2,938	71.4%
Jun-23	2,097,591	Friday, June 30, 2023	13	5,018	2,913	58.1%	Wednesday, June 7, 2023	19	4,326	86.2%
Annual	14,444,732	Annual Class Peak		6,060	1,649	27.2%	Annual System CP		276	4.6%
		Average 12 Monthly NCPs		2,857		57.7%	Average 12 Monthly CPs		2,098	73.4%
		Average Top 12 NCPs		5,859		28.1%	Average Top 12 CPs		291	5.0%
		Average Top 75 NCPs		5,623		29.3%	Average Top 75 CPs		311	5.5%
		Average Top 200 NCPs		5,400		30.5%	Average Top 200 CPs		393	7.3%
							Average 4CPs *		320	

Table 21 – Schedule 29 Class: Summary Statistics (Totals – kW)

Table 22 presents the data on an average-per-customer basis. The average annual use per customer in Rate Schedule 29 is 23,065 kWh with annual average peak demand of 9.68 kW.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Timing of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	4,386	Thursday, July 28, 2022	15	9.02	5.90	65.4%	Thursday, July 28, 2022	18	8.35	92.6%
Aug-22	4,751	Tuesday, August 9, 2022	12	8.36	6.39	76.4%	Monday, August 8, 2022	18	8.23	98.5%
Sep-22	3,020	Friday, September 2, 2022	11	6.77	4.19	62.0%	Thursday, September 1, 2022	18	6.42	94.8%
Oct-22	1,297	Monday, October 3, 2022	15	5.13	1.74	34.0%	Tuesday, October 25, 2022	19	0.52	10.2%
Nov-22	367	Friday, November 4, 2022	10	1.15	0.51	44.4%	Tuesday, November 29, 2022	18	0.50	43.4%
Dec-22	384	Friday, December 30, 2022	8	0.93	0.52	55.4%	Thursday, December 22, 2022	18	0.46	49.8%
Jan-23	407	Thursday, January 19, 2023	12	1.06	0.55	51.6%	Monday, January 30, 2023	9	0.62	58.4%
Feb-23	384	Friday, February 10, 2023	10	1.08	0.57	52.9%	Friday, February 24, 2023	8	0.60	55.2%
Mar-23	518	Wednesday, March 29, 2023	16	1.69	0.70	41.2%	Wednesday, March 1, 2023	8	0.56	33.1%
Apr-23	652	Friday, April 28, 2023	12	3.29	0.91	27.5%	Monday, April 3, 2023	9	0.63	19.3%
May-23	2,616	Friday, May 26, 2023	14	6.49	3.52	54.2%	Monday, May 15, 2023	18	4.63	71.4%
Jun-23	3,193	Friday, June 30, 2023	13	7.64	4.43	58.1%	Wednesday, June 7, 2023	19	6.59	86.2%
Annual	23,065	Annual Class Peak		9.68	2.63	27.2%	Annual System CP		0.44	4.6%

Table 22 – Schedule 29 Customer: Summary Statistics (Means – kW)

3.8 Schedules 10 & 31 Primary General Service

For Schedules 10 & 31 Large Primary General Service class, about 62% of the customers have interval load data, therefore the class profiles were developed by post-stratifying the data available. Table 23 presents the post-stratification used in the sample expansion analysis for both commercial and industrial class.

Maximum kWh	N(h)	n(h)	Case Weights
Commercial Customers			
1,407,440	225	139	1.62
2,973,655	67	47	1.43
5,776,855	39	22	1.77
10,202,480	23	13	1.77
28,351,375	13	8	1.63
Total	367	229	8.21
Industrial Customer			
2,870,360	76	44	1.73
6,307,200	18	13	1.38
10,648,145	12	6	2.00
18,021,510	7	6	1.17
36,579,205	5	4	1.25
Total	118	73	7.53

Table 23 – Schedules 10 & 31: Post-Stratification

In the next step, the average loss factor estimated for the primary voltage general service class was applied to the hourly expansions to produce the class hourly load profile. According to Table 4, the estimated average loss factor for Schedules 10 & 31 is 4.45%. Finally, the unaccounted for energy (UFE) was allocated to the Schedules 10 & 31 in proportion to preliminary estimate of its contribution to the system demand on an hourly basis.

Figure 23 presents the total load for the Schedules 10 & 31 class. The figure displays the EnergyPrint to the left of two-dimensional x-y plot. An overall consistency of the load throughout the year is clearly visible in the EnergyPrint. The Schedules 10 & 31 class peak occurred on Monday, August 30, 2022 at 3 PM. The class peak demand was 233.8 MW.

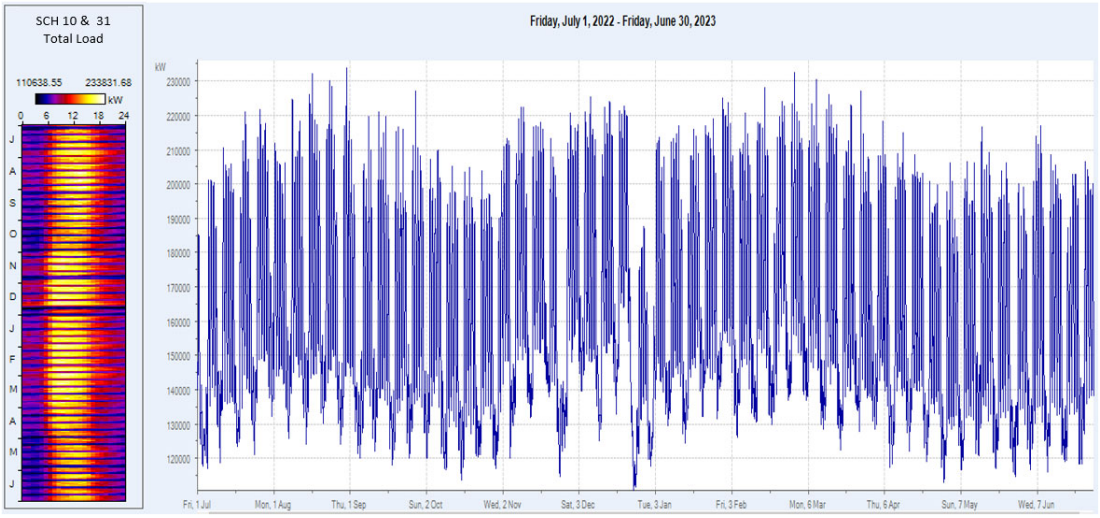

Figure 23 – Schedules 10 & 31 Class Total Load

Figure 24 presents Schedules 10 & 31 class load during the system peak eek of Sunday, December 18, 2022 through Saturday, December 24, 2022. The system peaked on Thursday December 22, 2022 at 6 PM. The class had a system peak hour load of 189.8 MW or 81.2% of the class peak demand of 233.8 MW.

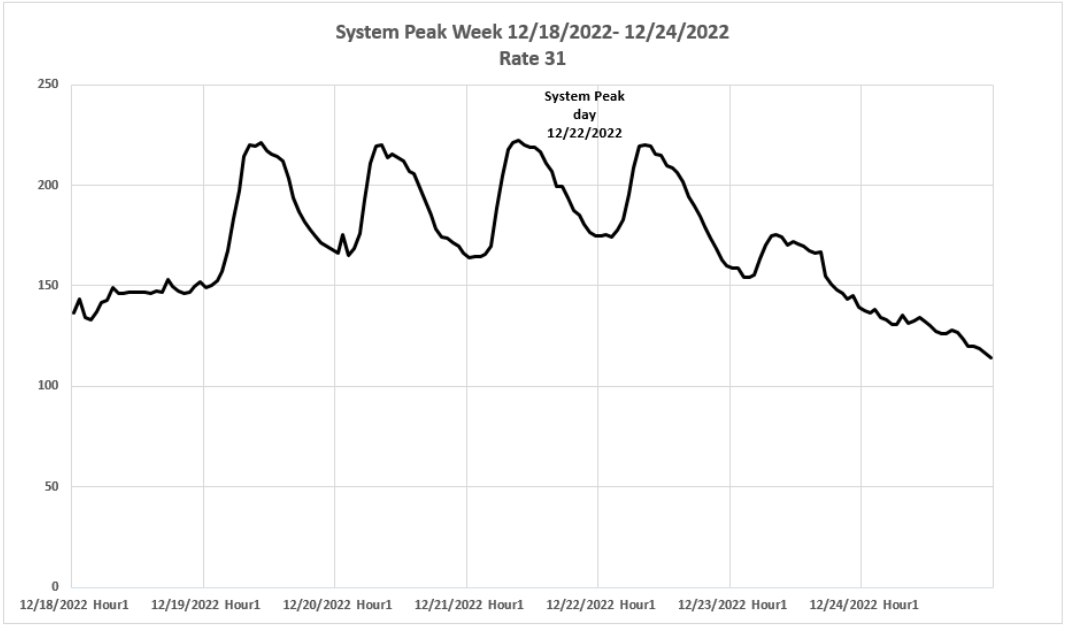

Figure 24 – Schedules 10 & 31: Total Load during System Peak Week

Figure 25 presents the monthly Schedules 10 & 31 class energy consumption, peak demand and load factor in graphics. Total monthly consumption as well as peak consumption fluctuate from month to month. Monthly load factor is around 70% across the months in the year.

Figure 25 – Schedules 10 & 31: Class Monthly Energy, Demand and Load Factor

Achieved precision of the Primary General Service class analysis is reflected in the difference between the sum of the estimated class hourly loads net of losses and the total actual sales to the class in the study period. The sum of estimated hourly loads net of losses was 1,347,106.7 MWh, 3.04% lower than the actual class sales of 1,389,392 MWh. The percentage of error is less than the maximum error margin of ±10% accepted in a typical load research practice.

Table 24 presents summary statistics for the Schedules 10 & 31 class load. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-month average coincident peak contributions, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. The Schedules 10 & 31 load is fairly coincident with the system peak displaying a system peak coincidence factor of over 80% for 10 of the 12 months.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	118,197,590	Tuesday, July 26, 2022	12	221,571	158,868	71.7%	Thursday, July 28, 2022	18	194,299	87.7%
Aug-22	124,754,676	Tuesday, August 30, 2022	15	233,832	167,681	71.7%	Monday, August 8, 2022	18	190,278	81.4%
Sep-22	114,508,011	Tuesday, September 27, 2022	13	226,960	159,039	70.1%	Thursday, September 1, 2022	18	184,529	81.3%
Oct-22	113,560,570	Thursday, October 6, 2022	15	209,846	152,635	72.7%	Tuesday, October 25, 2022	19	164,479	78.4%
Nov-22	118,535,177	Thursday, November 10, 2022	10	222,490	164,632	74.0%	Tuesday, November 29, 2022	18	182,308	81.9%
Dec-22	122,532,081	Wednesday, December 7, 2022	12	225,279	164,694	73.1%	Thursday, December 22, 2022	18	189,810	84.3%
Jan-23	122,494,149	Monday, January 30, 2023	9	225,148	164,643	73.1%	Monday, January 30, 2023	9	225,148	100.0%
Feb-23	113,312,435	Tuesday, February 28, 2023	10	232,446	168,620	72.5%	Friday, February 24, 2023	8	217,721	93.7%
Mar-23	123,548,066	Thursday, March 9, 2023	10	230,539	166,059	72.0%	Wednesday, March 1, 2023	8	214,530	93.1%
Apr-23	111,456,353	Wednesday, April 5, 2023	10	218,366	154,800	70.9%	Monday, April 3, 2023	9	208,101	95.3%
May-23	114,660,422	Monday, May 15, 2023	12	216,653	154,113	71.1%	Monday, May 15, 2023	18	181,970	84.0%
Jun-23	112,285,308	Thursday, June 8, 2023	13	216,778	155,952	71.9%	Wednesday, June 7, 2023	19	172,620	79.6%
Annual	1,409,844,837	Annual Class Peak		233,832	160,941	68.8%	Annual System CP		189,810	81.2%
		Average 12 Monthly NCPs		223,326		72.1%	Average 12 Monthly CPs		193,816	86.8%
		Average Top 12 NCPs		229,574		70.1%	Average Top 12 CPs		204,078	88.9%
		Average Top 75 NCPs		223,357		72.1%	Average Top 75 CPs		199,030	89.1%
		Average Top 200 NCPs		219,687		73.3%	Average Top 200 CPs		196,069	89.2%
							Average 4CPs *		203,747	

Table 24 – Schedules 10 & 31 Class: Summary Statistics (Totals – kW)

Table 25 presents the data on an average-per-customer basis. For a Schedules 10 & 31, the average use per customer is 2,812,658 kWh with annual average peak demand of 466.50 kW.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Timing of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	236,395	Tuesday, July 26, 2022	12	443.14	317.74	71.7%	Thursday, July 28, 2022	18	388.60	87.7%
Aug-22	250,009	Tuesday, August 30, 2022	15	468.60	336.03	71.7%	Monday, August 8, 2022	18	381.32	81.4%
Sep-22	229,475	Tuesday, September 27, 2022	13	454.83	318.72	70.1%	Thursday, September 1, 2022	18	369.80	81.3%
Oct-22	227,576	Thursday, October 6, 2022	15	420.53	305.88	72.7%	Tuesday, October 25, 2022	19	329.62	78.4%
Nov-22	236,597	Thursday, November 10, 2022	10	444.09	328.61	74.0%	Tuesday, November 29, 2022	18	363.89	81.9%
Dec-22	244,088	Wednesday, December 7, 2022	12	448.76	328.08	73.1%	Thursday, December 22, 2022	18	378.11	84.3%
Jan-23	243,527	Monday, January 30, 2023	9	447.61	327.32	73.1%	Monday, January 30, 2023	9	447.61	100.0%
Feb-23	226,173	Tuesday, February 28, 2023	10	463.96	336.57	72.5%	Friday, February 24, 2023	8	434.57	93.7%
Mar-23	245,622	Thursday, March 9, 2023	10	458.33	330.14	72.0%	Wednesday, March 1, 2023	8	426.50	93.1%
Apr-23	221,583	Wednesday, April 5, 2023	10	434.13	307.75	70.9%	Monday, April 3, 2023	9	413.72	95.3%
May-23	227,501	Monday, May 15, 2023	12	429.87	305.78	71.1%	Monday, May 15, 2023	18	361.05	84.0%
Jun-23	224,122	Thursday, June 8, 2023	13	432.69	311.28	71.9%	Wednesday, June 7, 2023	19	344.55	79.6%
Annual	2,812,658	Annual Class Peak		466.50	321.08	68.8%	Annual System CP		378.67	81.2%

Table 25 – Schedules 10 & 31 Customer: Summary Statistics (Means – kW)

3.9 Schedule 35 Primary Seasonal Irrigation

The Schedule 35 Primary Seasonal Irrigation is one of the deem profiles with almost 99% of its interval load data available and hence this data did not go through a population expansion process. The estimated average loss factor applied to the class load is 4.52%, according to Table 4.

Figure 26 presents the total load for the Schedule 35 class. The figure displays the EnergyPrint to the left of two-dimensional x-y plot. The dominance of the summer seasonal load is obvious with almost no load during the winter months. The Schedule 35 class peak occurred on Wednesday, August 17, 2022 at 10 PM. The class peak demand was 13.4 MW.

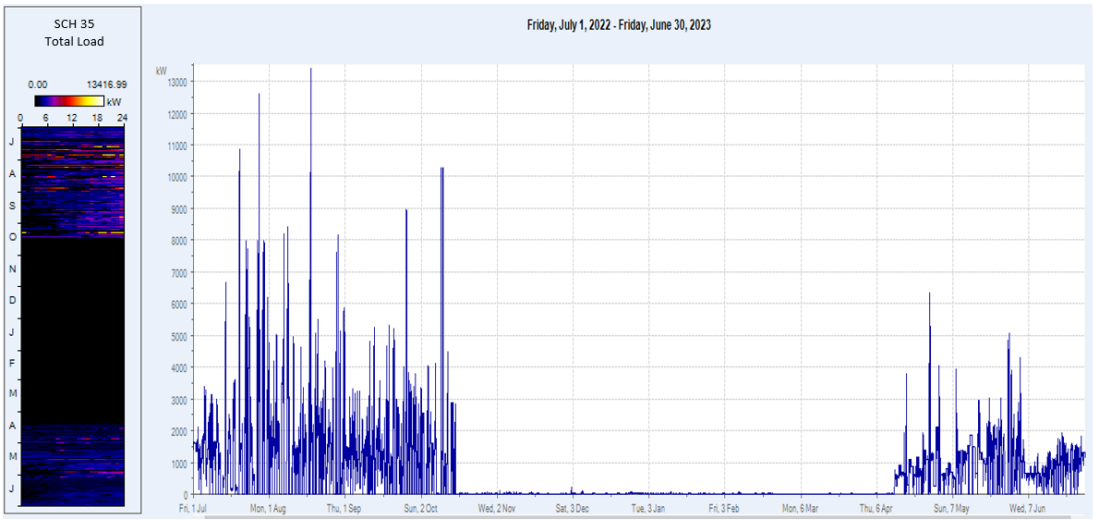

Figure 26 – Schedule 35: Class Total Load

There was almost no demand during the system peak week of December 18 – December 24, 2023, hence not displayed.

Figure 27 presents the monthly Schedule 35 class energy consumption, peak demand and load factor in graphics. As shown in the graphs, Schedule 35 load is highly summer seasonal with virtually no load during the winter period.

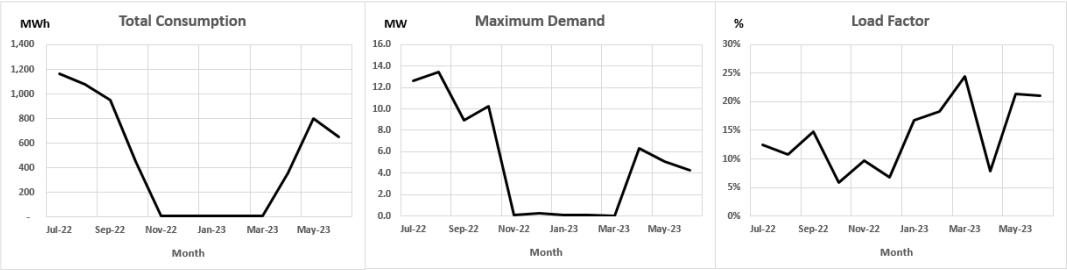

Figure 27 – Schedule 35: Class Monthly Energy, Demand and Load Factors

Since population data are available for all customers and they are all reconciled with the total sales, the precision is almost perfect for this class.

Table 26 presents summary statistics for the Schedule 35 class. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-month average coincident peak contributions, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. The class displays virtually no load in the winter months therefore the class load at the system peak was merely 1 kW.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	1,162,003	Wednesday, July 27, 2022	21	12,606	1,562	12.4%	Thursday, July 28, 2022	18	1	0.0%
Aug-22	1,082,136	Wednesday, August 17, 2022	22	13,417	1,454	10.8%	Monday, August 8, 2022	18	1,576	11.7%
Sep-22	953,845	Sunday, September 25, 2022	24	8,946	1,325	14.8%	Thursday, September 1, 2022	18	1,325	14.8%
Oct-22	452,867	Monday, October 10, 2022	1	10,285	609	5.9%	Tuesday, October 25, 2022	19	17	0.2%
Nov-22	8,088	Wednesday, November 2, 2022	24	116	11	9.7%	Tuesday, November 29, 2022	18	2	2.0%
Dec-22	11,604	Friday, December 2, 2022	6	230	16	6.8%	Thursday, December 22, 2022	18	1	0.6%
Jan-23	8,801	Wednesday, January 11, 2023	23	71	12	16.7%	Monday, January 30, 2023	9	1	1.8%
Feb-23	7,750	Wednesday, February 8, 2023	24	63	12	18.2%	Friday, February 24, 2023	8	8	12.4%
Mar-23	8,801	Sunday, March 26, 2023	12	49	12	24.4%	Wednesday, March 1, 2023	8	11	22.8%
Apr-23	361,145	Thursday, April 27, 2023	16	6,343	502	7.9%	Monday, April 3, 2023	9	18	0.3%
May-23	803,310	Monday, May 29, 2023	24	5,050	1,080	21.4%	Monday, May 15, 2023	18	1,489	29.5%
Jun-23	650,749	Saturday, June 3, 2023	10	4,285	904	21.1%	Wednesday, June 7, 2023	19	889	20.8%
Annual	5,511,099	Annual Class Peak		13,417	629	4.7%	Annual System CP		1	0.0%
		Average 12 Monthly NCPs		5,122		12.3%	Average 12 Monthly CPs		445	8.7%
		Average Top 12 NCPs		10,891		5.8%	Average Top 12 CPs		3	0.0%
		Average Top 75 NCPs		7,546		8.3%	Average Top 75 CPs		8	0.1%
		Average Top 200 NCPs		5,536		11.4%	Average Top 200 CPs		28	0.5%
							Average 4CPs *		3	

* Monthly CPs for November, December, January and February

Table 26 – Schedule 35 Class: Summary Statistics (Totals – kW)

Although currently two customers are served under the Primary Seasonal Irrigation class, because of the dominance of one customer no summary table is presented on a per-customer basis.

3.10 Schedule 43 Interruptible Primary Service for Electric Schools

For Schedule 43 Interruptible Primary Service for Electric Schools class, interval data were available for about 70% of the population. Therefore the class profiles were developed by expanding the available sample data to the population level by post-stratification. Table 27 presents the post-stratification used in the sample expansion analysis.

Maximum kWh	N(h)	n(h)	Case Weights
All Customers			
525,235	50	37	1.35
720,145	36	26	1.38
1,044,995	27	18	1.50
1,750,540	19	12	1.58
6,533,135	11	7	1.57
Total	143	100	7.39

Table 27 – Schedule 43: Post-Stratification

In the second step, the average loss factor estimated for Schedule 43 was applied to the hourly expansion. As stated in Table 4, the estimated average loss factor is 4.39%.

Figure 28 presents the total load for the Schedule 43 class. The figure displays the EnergyPrint to the left of two-dimensional x-y plot. The dominance of the winter seasonal load and the summer shut-down of schools are clearly evident. The Schedule 43 class peak occurred on Tuesday, January 30, 2023 at 10 AM. The class peak demand was 52.7 MW.

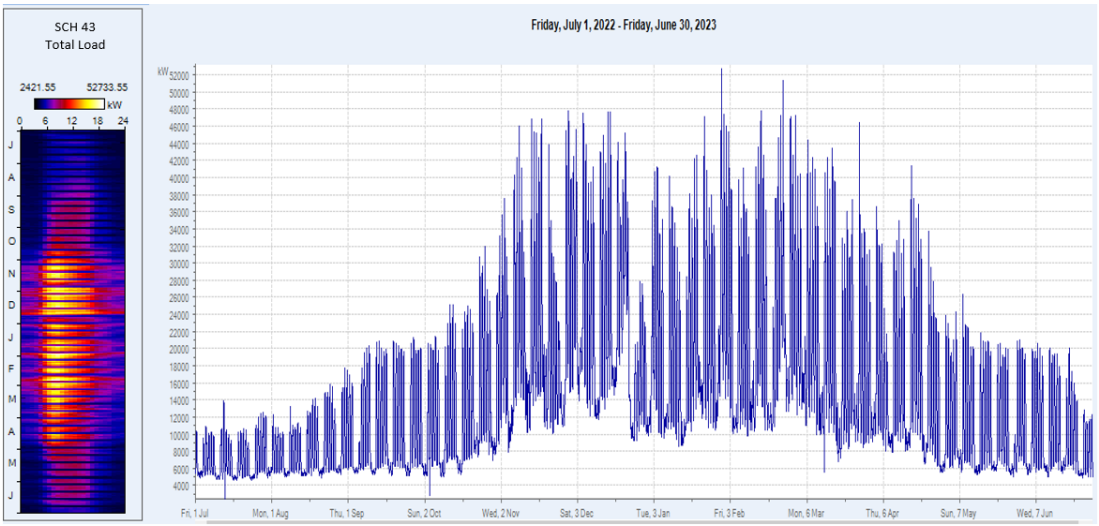

Figure 28 – Schedule 43: Class Total Load

Figure 29 presents the total Schedule 43 load during the system peak week of Sunday, December 18, 2022 through Saturday, December 24, 2022. The class had a system peak hour load of 31.4 MW or 59.6% of the class peak demand of 52.7 MW.

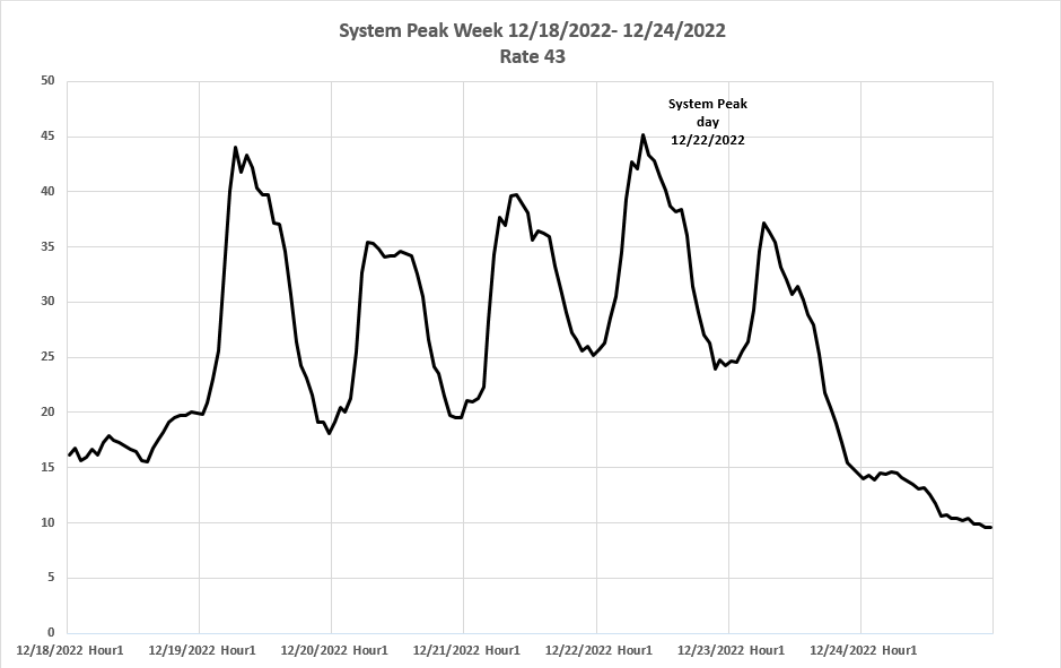

Figure 29 – Schedule 43: Total Load during System Peak Week

Figure 30 presents the monthly Schedule 43 class energy consumption, peak demand and load factor in graphics. As shown in the graphs, the Interruptible Primary Service load of all-electric schools is highly seasonal with electric space-heating load in the winter months. The loads in July and August are substantially lower, reflecting the annual summer break at schools.

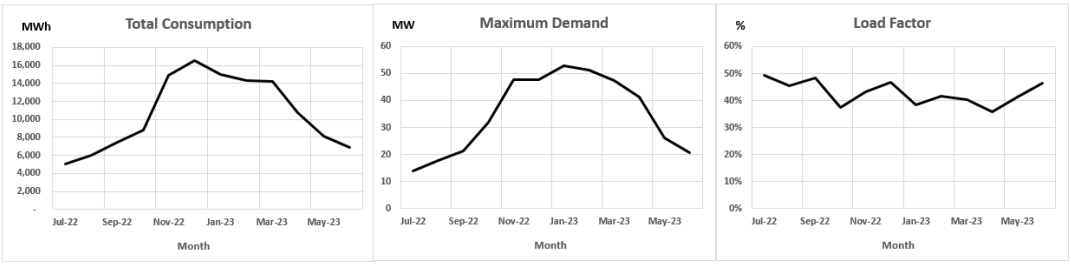

Figure 30 – Schedule 43: Class Monthly Energy, Demand and Load Factor

Achieved precision of the Interruptible Primary Service class analysis can be evaluated in terms of the difference between the sum of the estimated class hourly loads net of losses for the study period and the total actual sales to the class in the same period. The sum of estimated hourly loads net of losses was 122,431.8 MWh, 2.91% lower than the actual class sales of 126,106.8 MWh. The percentage of error is substantially lower than the maximum tolerable error margin of ±10% allowed in a typical load research practice.

Table 28 presents summary statistics for the Schedule 43 class load. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of

system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-month average coincident peak contributions, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. The monthly NCP load factor tends to be low and ranges from a low of 36% in April, 2023 to a high of 49% in July, 2022. The system coincidence factors fluctuate from 45.4% in May 2023 to 100.0% in February, 2023.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	5,096,927	Tuesday, July 12, 2022	13	13,840	6,851	49%	Thursday, July 28, 2022	18	8,981	64.9%
Aug-22	6,002,407	Tuesday, August 30, 2022	15	17,681	8,068	46%	Monday, August 8, 2022	18	8,643	48.9%
Sep-22	7,424,467	Tuesday, September 27, 2022	13	21,342	10,312	48%	Thursday, September 1, 2022	18	11,576	54.2%
Oct-22	8,862,959	Wednesday, October 26, 2022	9	31,879	11,913	37%	Tuesday, October 25, 2022	19	15,105	47.4%
Nov-22	14,878,833	Tuesday, November 29, 2022	9	47,836	20,665	43%	Tuesday, November 29, 2022	18	24,787	51.8%
Dec-22	16,572,119	Friday, December 16, 2022	9	47,641	22,274	47%	Thursday, December 22, 2022	18	31,409	65.9%
Jan-23	15,010,891	Monday, January 30, 2023	10	52,734	20,176	38%	Monday, January 30, 2023	9	51,769	98.2%
Feb-23	14,321,892	Friday, February 24, 2023	8	51,331	21,312	42%	Friday, February 24, 2023	8	51,331	100.0%
Mar-23	14,212,320	Wednesday, March 1, 2023	9	47,296	19,103	40%	Wednesday, March 1, 2023	8	46,092	97.5%
Apr-23	10,707,204	Monday, April 17, 2023	8	41,408	14,871	36%	Monday, April 3, 2023	9	35,335	85.3%
May-23	8,100,248	Monday, May 8, 2023	8	26,274	10,887	41%	Monday, May 15, 2023	18	11,930	45.4%
Jun-23	6,863,101	Wednesday, June 7, 2023	12	20,571	9,532	46%	Wednesday, June 7, 2023	19	9,832	47.8%
Annual	128,053,368	Annual Class Peak		52,734	14,618	28%	Annual System CP		31,409	59.6%
		Average 12 Monthly NCPs		34,986		42%	Average 12 Monthly CPs		25,566	73.1%
		Average Top 12 NCPs		49,556		29%	Average Top 12 CPs		36,581	73.8%
		Average Top 75 NCPs		45,721		32%	Average Top 75 CPs		34,991	76.5%
		Average Top 200 NCPs		42,774		34%	Average Top 200 CPs		33,424	78.1%
							Average 4CPs *		39,824	

* Monthly CPs for November, December, January and February

Table 28 – Schedule 43 Class: Summary Statistics (Totals – kW)

Table 29 presents the data on an average-per-customer basis. The annual average use per customer for Schedule 43 is estimated to be 893 MWh with annual average peak demand of 367.7 kW.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Timing of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	35,395	Tuesday, July 12, 2022	13	96.11	47.57	49.5%	Thursday, July 28, 2022	18	62.37	64.9%
Aug-22	41,683	Tuesday, August 30, 2022	15	122.78	56.03	45.6%	Monday, August 8, 2022	18	60.02	48.9%
Sep-22	51,559	Tuesday, September 27, 2022	13	148.21	71.61	48.3%	Thursday, September 1, 2022	18	80.39	54.2%
Oct-22	61,548	Wednesday, October 26, 2022	9	221.38	82.73	37.4%	Tuesday, October 25, 2022	19	104.90	47.4%
Nov-22	103,325	Tuesday, November 29, 2022	9	332.20	143.51	43.2%	Tuesday, November 29, 2022	18	172.13	51.8%
Dec-22	115,889	Friday, December 16, 2022	9	333.15	155.76	46.8%	Thursday, December 22, 2022	18	219.64	65.9%
Jan-23	104,971	Monday, January 30, 2023	10	368.77	141.09	38.3%	Monday, January 30, 2023	9	362.02	98.2%
Feb-23	100,153	Friday, February 24, 2023	8	358.96	149.04	41.5%	Friday, February 24, 2023	8	358.96	100.0%
Mar-23	99,387	Wednesday, March 1, 2023	9	330.74	133.58	40.4%	Wednesday, March 1, 2023	8	322.32	97.5%
Apr-23	74,876	Monday, April 17, 2023	8	289.57	103.99	35.9%	Monday, April 3, 2023	9	247.10	85.3%
May-23	56,645	Monday, May 8, 2023	8	183.73	76.14	41.4%	Monday, May 15, 2023	18	83.42	45.4%
Jun-23	47,994	Wednesday, June 7, 2023	12	143.85	66.66	46.3%	Wednesday, June 7, 2023	19	68.76	47.8%
Annual	892,876	Annual Class Peak		367.69	101.93	27.7%	Annual System CP		219.00	59.6%

Table 29 – Schedule 43 Customer: Summary Statistics (Means – kW)

3.11 Schedule 46 High Voltage Interruptible Service

Since the 15-minute interval load data are available for all of the loads on Schedule 46, the Schedule 46 High Voltage Interruptible Service class hourly loads were calculated on the basis of the actual interval load data collected for population. Finally, the average loss factor estimated for the high voltage interruptible service was applied to the hourly loads. Table 4 shows that the estimated average loss factor is 1.83%.

Figure 31 presents the total load for the Schedule 46 class. The figure displays the EnergyPrint to the left of two-dimensional x-y plot. No significant seasonality is observed with this class load. The Schedule 46 class peak occurred on Thursday July 21, 2022 at 12 PM. The class peak demand was 20.9 MW.

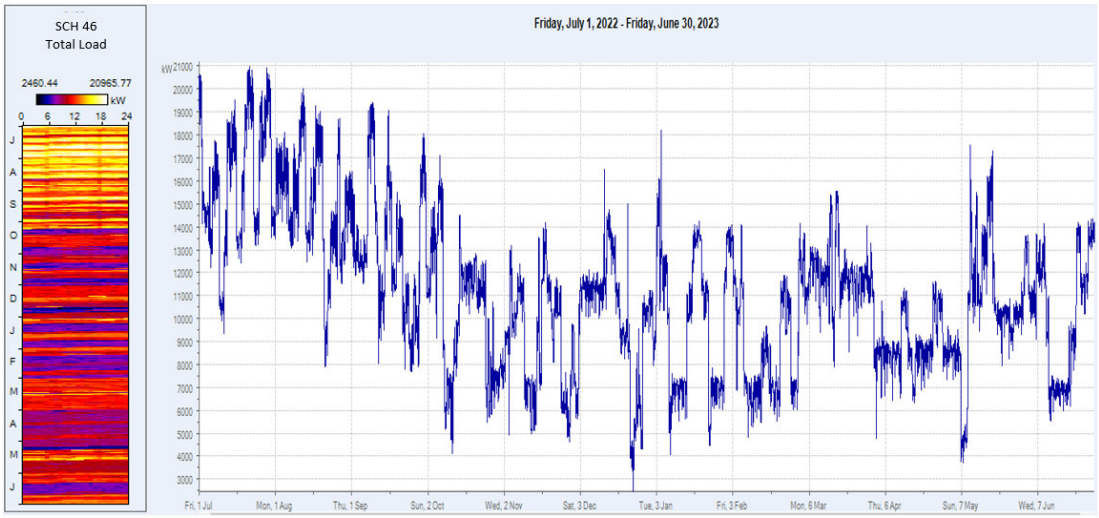

Figure 31 – Schedule 46: Class Total Load

Figure 32 presents the total Schedule 46 class load for the system peak week of Sunday, December 18, 2022 through Saturday, December 24, 2022. The class had a system peak hour load of 8.8 MW, or 41.9% of the July class peak demand of 20.9 MW.

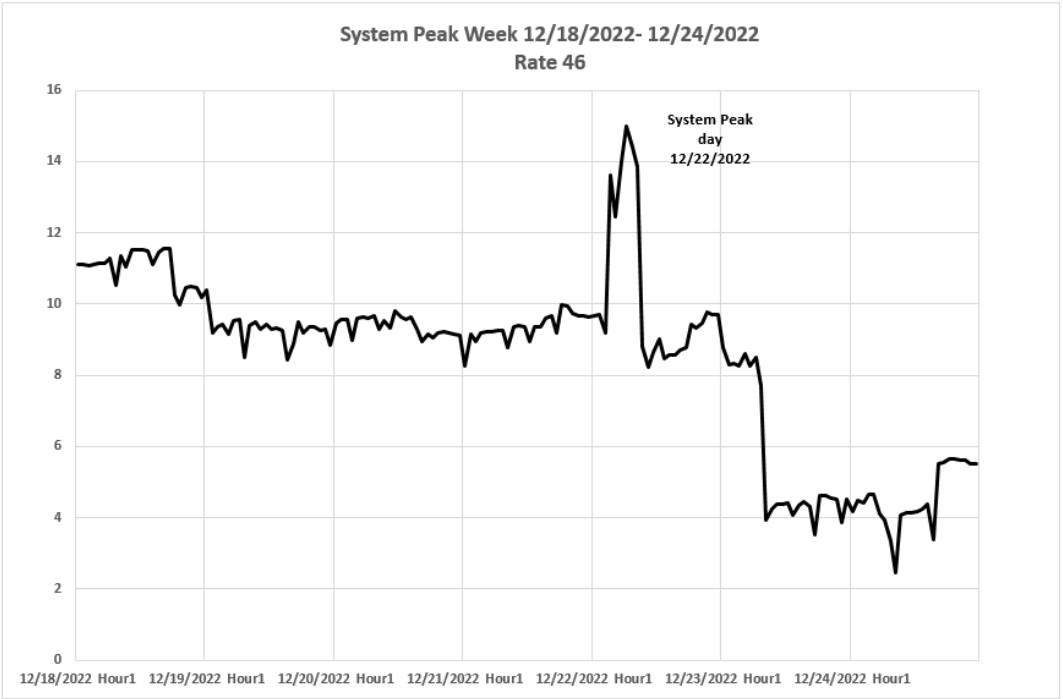

Figure 32 – Schedule 46: Total Load during System Peak Week

Figure 33 shows the monthly energy consumption, peak demand and load factor of the Schedule 46 class in graphics. As illustrated in the graphs, the interruptible high voltage service load of Schedule 46 tends to have slightly higher load in the summer than in the winter,

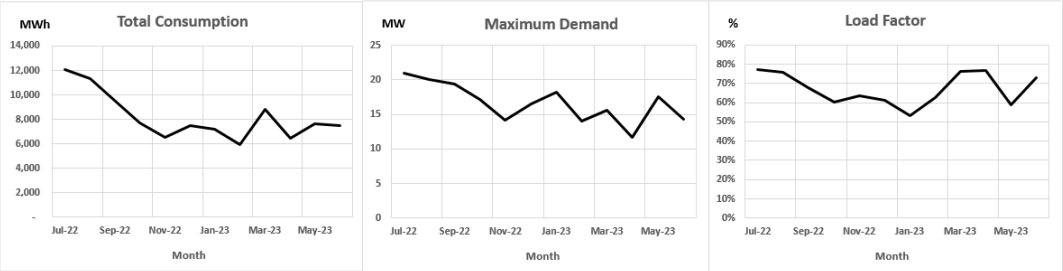

Figure 33 – Schedule 46: Class Monthly Energy, Demand and Load Factor

The achieved precision is expected to be perfect since the interval load data for all of the customers in this rate class were available for the full twelve-month period examined.

Table 30 presents summary statistics for the Schedule 46 class load. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-month average coincident peak contributions, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. The class displays little volatility in its monthly energy use and peak demand. The monthly class load factors range from a low of 53.2% in January 2023 to a high of 77.4% in July, 2022. The load is coincident with the system peak with a coincidence factor over 70% for 4 of the 12 months.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	12,072,905	Thursday, July 21, 2022	12	20,966	16,227	77.4%	Thursday, July 28, 2022	18	18,592	88.7%
Aug-22	11,304,565	Friday, August 12, 2022	10	19,995	15,194	76.0%	Monday, August 8, 2022	18	13,547	67.8%
Sep-22	9,468,584	Friday, September 9, 2022	14	19,391	13,151	67.8%	Thursday, September 1, 2022	18	12,652	65.2%
Oct-22	7,694,363	Thursday, October 6, 2022	23	17,119	10,342	60.4%	Tuesday, October 25, 2022	19	6,459	37.7%
Nov-22	6,502,478	Friday, November 18, 2022	19	14,181	9,031	63.7%	Tuesday, November 29, 2022	18	9,126	64.4%
Dec-22	7,504,324	Monday, December 12, 2022	17	16,493	10,086	61.2%	Thursday, December 22, 2022	18	8,780	53.2%
Jan-23	7,209,027	Wednesday, January 4, 2023	19	18,220	9,690	53.2%	Monday, January 30, 2023	9	7,414	40.7%
Feb-23	5,922,655	Thursday, February 2, 2023	15	14,077	8,813	62.6%	Friday, February 24, 2023	8	11,664	82.9%
Mar-23	8,832,653	Friday, March 17, 2023	2	15,545	11,872	76.4%	Wednesday, March 1, 2023	8	7,338	47.2%
Apr-23	6,421,367	Wednesday, April 26, 2023	10	11,630	8,919	76.7%	Monday, April 3, 2023	9	8,640	74.3%
May-23	7,673,451	Wednesday, May 10, 2023	13	17,550	10,314	58.8%	Monday, May 15, 2023	18	12,113	69.0%
Jun-23	7,516,422	Thursday, June 29, 2023	10	14,337	10,439	72.8%	Wednesday, June 7, 2023	19	13,449	93.8%
Annual	98,122,792	Annual Class Peak		20,966	11,201	53.4%	Annual System CP		8,780	41.9%
		Average 12 Monthly NCPs		16,625		67.4%	Average 12 Monthly CPs		10,815	65.0%
		Average Top 12 NCPs		20,724		54.0%	Average Top 12 CPs		9,917	47.9%
		Average Top 75 NCPs		20,292		55.2%	Average Top 75 CPs		8,847	43.6%
		Average Top 200 NCPs		19,684		56.9%	Average Top 200 CPs		9,773	49.7%
							Average 4CPs *		9,246	

* Monthly CPs for November, December, January and February

Table 30 – Schedule 46 Class: Summary Statistics (Totals – kW)

Since only six customers are served under the Interruptible High Voltage Service rate, no summary table is presented on a per-customer basis.

3.12 Schedule 49 High Voltage General Service

Since all of the customers in the High Voltage General Service class are metered with interval load readings, the entire load data for the class was used for the class hourly load profiling. The average loss factor estimated for the class was applied to the hourly loads. Table 4 shows that the estimated average loss factor is 1.69%.

Figure 34 presents the results for the Schedule 49 class. The figure displays the EnergyPrint to the left of two-dimensional x-y plot. The annual load profile does not show much seasonality across months. The Schedule 49 class peak occurred on Thursday, June 7, 2023 at 2 PM. The class peak demand was 80.5 MW.

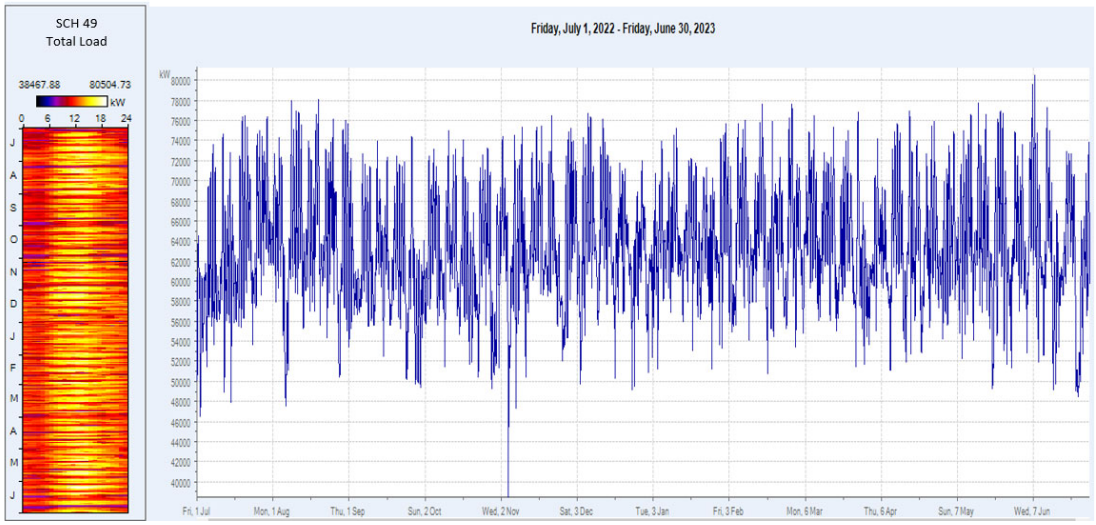

Figure 34 – Schedule 49: Class Total Load

Figure 35 presents the total Schedule 49 class load for the system peak week of Sunday, December 18, 2022 through Saturday, December 24, 2022. The class had a system peak hour load of 65.8 MW or 81.7% of the June class peak demand of 80.5 MW.

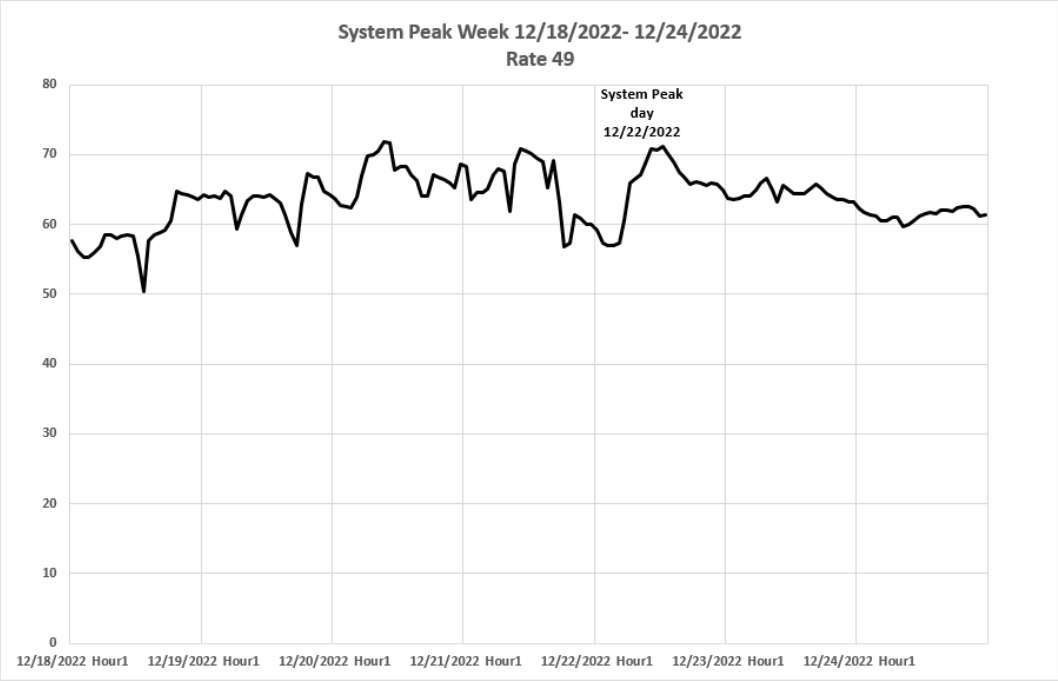

Figure 35 – Schedule 49: Total Load during System Peak Week

Figure 36 presents the monthly energy consumption, peak demand and load factors of the Schedule 49 class in charts. As shown in the charts, the High Voltage General Service loads were stable throughout the year and the percentage difference between the highest monthly peak of 80.5 MW and the lowest monthly peak load of 74.4 MW was only 8%.

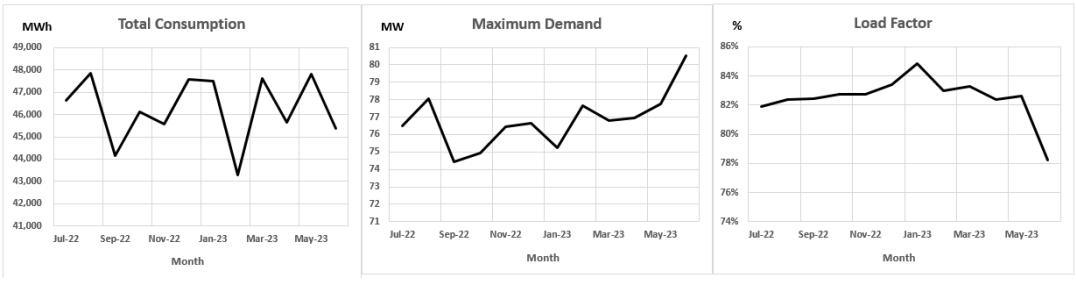

Figure 36 – Schedule 49: Class Monthly Energy, Demand and Load Factor

The achieved precision for this class was perfect since the interval load data for all of the customers in this rate class were available for the full twelve-month period examined.

Table 31 presents summary statistics for the Schedule 49 class load. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-

month average coincident peak contributions, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. The monthly class NCP load factors are high and stable, ranging from a low of 78.2% in June, 2023 to a high of 84.8% in January. 2023. The load is highly coincident with the system peak with a coincidence factor over 85% for all of the 12 months.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	46,628,281	Wednesday, July 20, 2022	13	76,518	62,672	81.9%	Thursday, July 28, 2022	18	66,641	87.1%
Aug-22	47,850,480	Friday, August 19, 2022	13	78,059	64,315	82.4%	Monday, August 8, 2022	18	71,201	91.2%
Sep-22	44,162,562	Monday, September 26, 2022	15	74,417	61,337	82.4%	Thursday, September 1, 2022	18	72,153	97.0%
Oct-22	46,119,570	Tuesday, October 11, 2022	14	74,934	61,989	82.7%	Tuesday, October 25, 2022	19	67,399	89.9%
Nov-22	45,565,384	Tuesday, November 22, 2022	13	76,459	63,285	82.8%	Tuesday, November 29, 2022	18	69,502	90.9%
Dec-22	47,573,439	Wednesday, December 7, 2022	14	76,668	63,943	83.4%	Thursday, December 22, 2022	18	65,805	85.8%
Jan-23	47,489,632	Thursday, January 12, 2023	13	75,240	63,830	84.8%	Monday, January 30, 2023	9	70,022	93.1%
Feb-23	43,310,028	Tuesday, February 28, 2023	14	77,635	64,449	83.0%	Friday, February 24, 2023	8	66,068	85.1%
Mar-23	47,614,770	Monday, March 27, 2023	14	76,818	63,998	83.3%	Wednesday, March 1, 2023	8	65,417	85.2%
Apr-23	45,635,687	Monday, April 17, 2023	14	76,955	63,383	82.4%	Monday, April 3, 2023	9	70,216	91.2%
May-23	47,801,220	Monday, May 15, 2023	13	77,768	64,249	82.6%	Monday, May 15, 2023	18	71,242	91.6%
Jun-23	45,356,155	Wednesday, June 7, 2023	14	80,505	62,995	78.2%	Wednesday, June 7, 2023	19	71,792	89.2%
Annual	555,107,209	Annual Class Peak		80,505	63,368	78.7%	Annual System CP		65,805	81.7%
		Average 12 Monthly NCPs		76,831		82.5%	Average 12 Monthly CPs		68,955	89.7%
		Average Top 12 NCPs		78,894		80.3%	Average Top 12 CPs		65,962	83.6%
		Average Top 75 NCPs		76,900		82.4%	Average Top 75 CPs		66,266	86.2%
		Average Top 200 NCPs		75,857		0.0%	Average Top 200 CPs		66,862	88.1%
							Average 4CPs *		67,850	

* Monthly CPs for November, December, January and February

Table 31 – Schedule 49 Class: Summary Statistics (Totals – MW)

Table 32 presents the data on an average-per-customer basis. There were about 17 customers under Schedule 49 during the study period. The average use per customer in the class is estimated to be 32,653 MWh with annual average peak demand of 4,736 kW.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Timing of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	2,742,840	Wednesday, July 20, 2022	13	4,501	3,687	81.9%	Thursday, July 28, 2022	18	3,920	87.1%
Aug-22	2,814,734	Friday, August 19, 2022	13	4,592	3,783	82.4%	Monday, August 8, 2022	18	4,188	91.2%
Sep-22	2,597,798	Monday, September 26, 2022	15	4,377	3,608	82.4%	Thursday, September 1, 2022	18	4,244	97.0%
Oct-22	2,712,916	Tuesday, October 11, 2022	14	4,408	3,646	82.7%	Tuesday, October 25, 2022	19	3,965	89.9%
Nov-22	2,680,317	Tuesday, November 22, 2022	13	4,498	3,723	82.8%	Tuesday, November 29, 2022	18	4,088	90.9%
Dec-22	2,798,438	Wednesday, December 7, 2022	14	4,510	3,761	83.4%	Thursday, December 22, 2022	18	3,871	85.8%
Jan-23	2,793,508	Thursday, January 12, 2023	13	4,426	3,755	84.8%	Monday, January 30, 2023	9	4,119	93.1%
Feb-23	2,547,649	Tuesday, February 28, 2023	14	4,567	3,791	83.0%	Friday, February 24, 2023	8	3,886	85.1%
Mar-23	2,800,869	Monday, March 27, 2023	14	4,519	3,765	83.3%	Wednesday, March 1, 2023	8	3,848	85.2%
Apr-23	2,684,452	Monday, April 17, 2023	14	4,527	3,728	82.4%	Monday, April 3, 2023	9	4,130	91.2%
May-23	2,811,836	Monday, May 15, 2023	13	4,575	3,779	82.6%	Monday, May 15, 2023	18	4,191	91.6%
Jun-23	2,668,009	Wednesday, June 7, 2023	14	4,736	3,706	78.2%	Wednesday, June 7, 2023	19	4,223	89.2%
Annual	32,653,365	Annual Class Peak		4,736	3,728	78.7%	Annual System CP		3,871	81.7%

Table 32 – Schedule 49 Customer: Summary Statistics (Means – kW)

3.13 Schedules 50-59 Area and Street Lighting

The Area and Street Lighting hourly load profiles were produced by allocating the energy sales to those customer classes billed during the study period to each day and hour, based on the daily and hourly lighting energy requirements calculated with the lighting fixture and capacity data and the daily sunset and sunrise times. The portion of traffic lighting energy use was estimated with the traffic lighting fixture and wattage data for the study period. PSE started installing metered smart lights starting mid to late 2022, however, clean and consistent meter reading for the smart lights are not available for most of the study period. Therefore, for this rate case, PSE continues to estimate the lighting profiles as in the previous general rate case studies.

Average loss factor estimated for the Area and Street Lighting classes was applied to the hourly load estimates. The estimated loss factor is 10.87%.

Figure 37 and Figure 38 present the class total load results for the two lighting classes. The figure displays the EnergyPrint to the left of two-dimensional x-y plot. The lighting loads track the nighttime hours. Both the Area Lighting class load and the Street Lighting class load reach their peaks after the sunset and stay at the peak levels during the nighttime hours. The Area Lighting class peak was 1.5 MW, while the Street Lighting class peak was 15.7 MW.

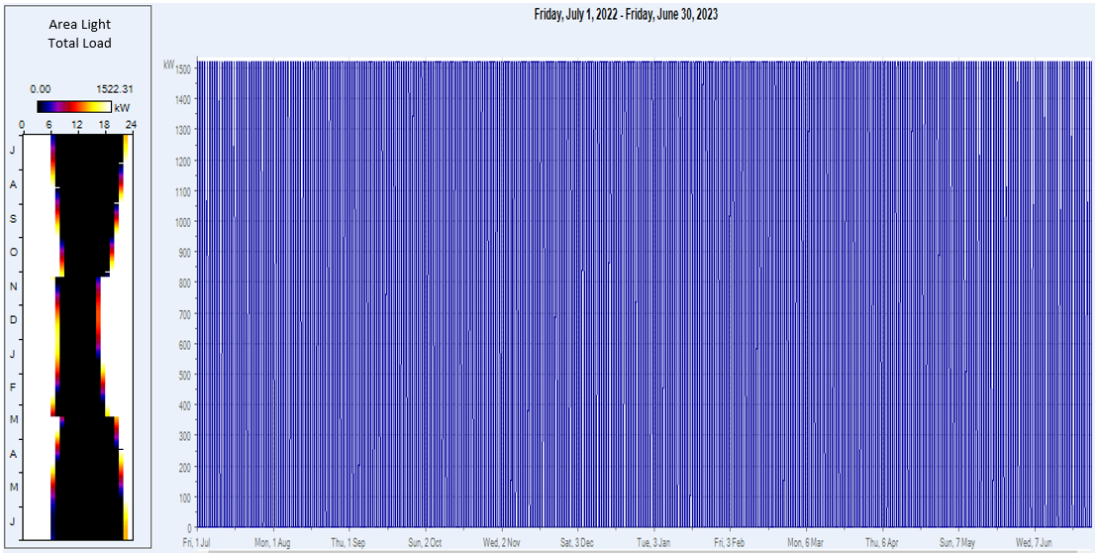

Figure 37 – Area Lighting: Class Total Load

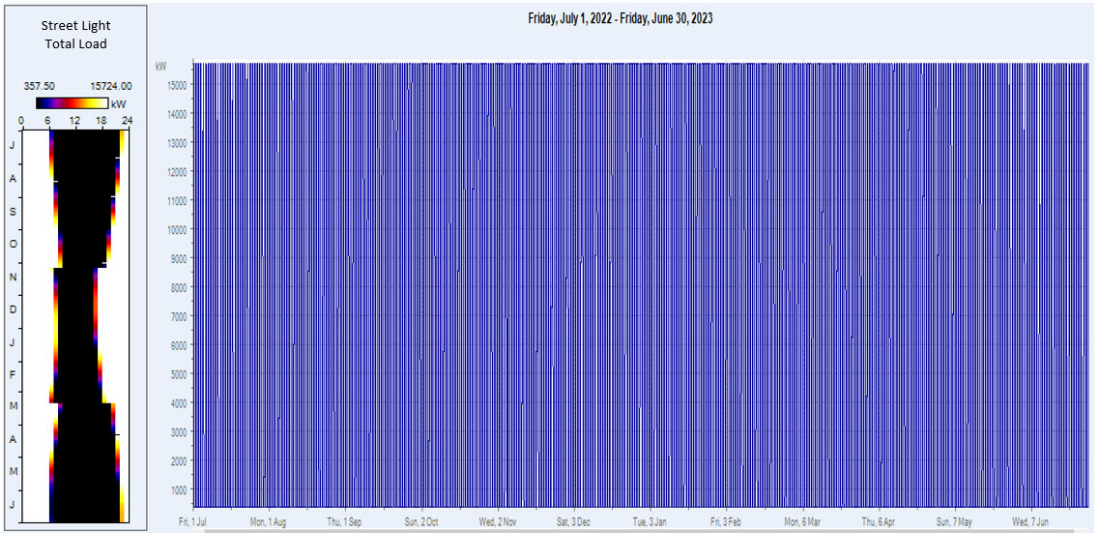

Figure 38 – Street Lighting: Class Total Load

Figure 39 and Figure 40 present the total loads of the lighting classes for the system peak week of Sunday, December 18, 2022 through Saturday, December 24, 2022. The Area Lighting class and street lighting, both had system coincident peak demand is same as the class peak demand resulting in a 100% coincidence factor.

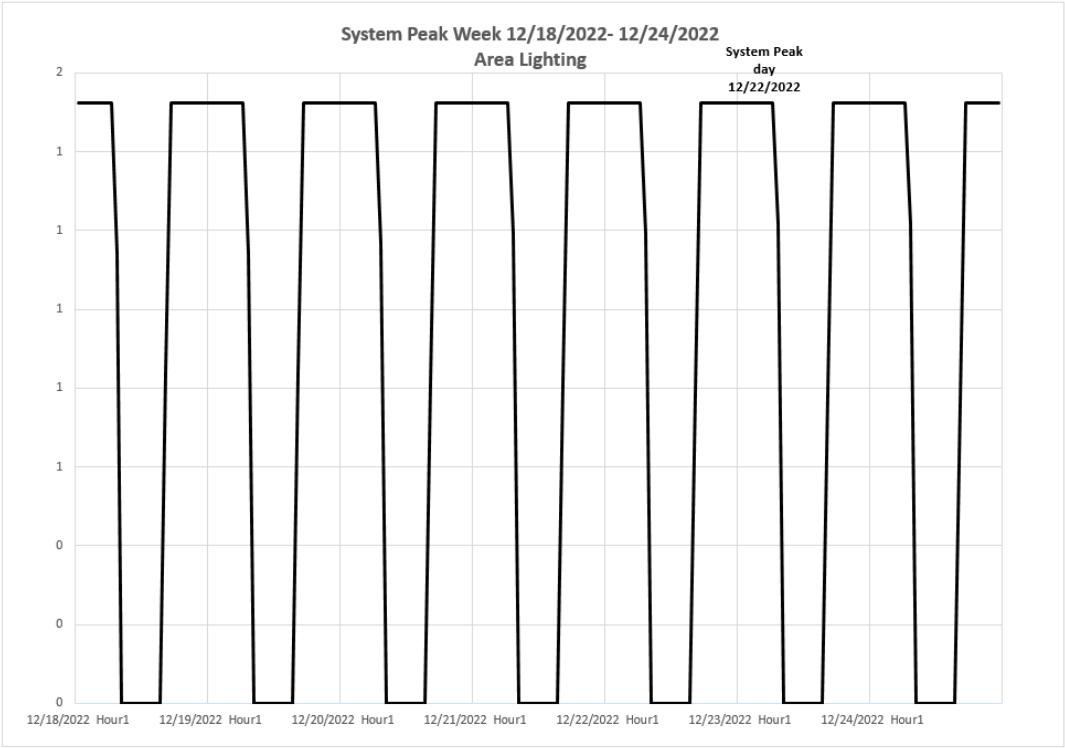

Figure 39 – Area Lighting: Total Load during System Peak Week

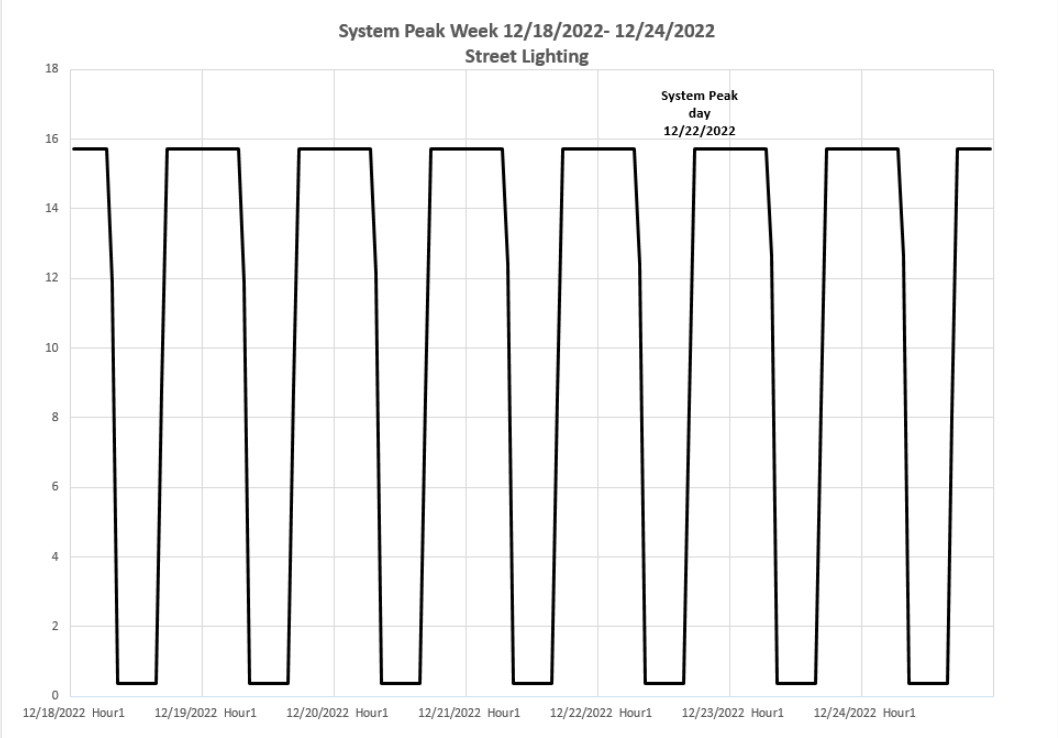

Figure 40 – Street Lighting: Total Load during System Peak Week

Figure 41 and Figure 42 presents the monthly energy consumption, peak demand and load factors of the lighting classes in charts. As reflected in the monthly energy consumption and maximum demand charts, the lighting classes consume more electricity in the winter months due to a longer lighting period, while the maximum demand stays about the same with the number of lighting fixtures and their wattage requirements changing rarely month to month.

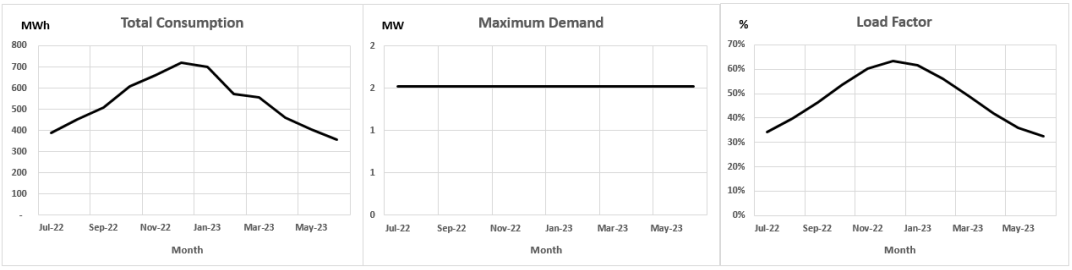

Figure 41 – Area Lighting: Class Monthly Energy, Demand and Load Factor

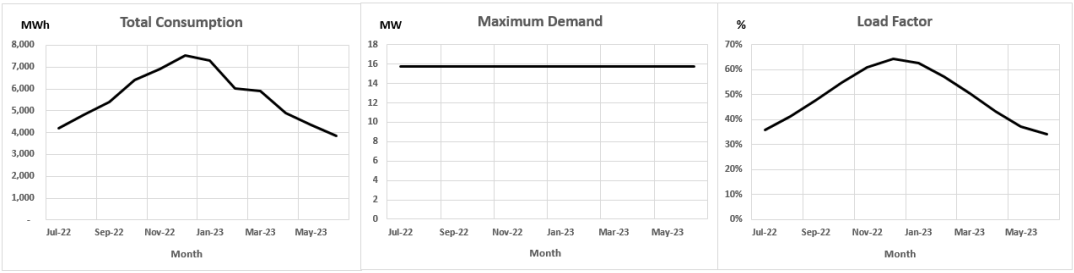

Figure 42 – Street Lighting: Class Monthly Energy, Demand and Load Factor

Table 33 and Table 34 present summary statistics for the lighting classes. Each table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-month average coincident peak contributions, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. The lighting class load factors tend to be higher in the winter months reflecting more lighting hours in the winter but the monthly maximum demand staying same throughout the study period. Monthly load factors ranges from low 30% to low to mid 60%. Monthly system coincidence factors are 100% in November and December, 2022, and zero or close to zero for the rest of the year.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	388,495	Friday, July 1, 2022	1	1,522	522	34.3%	Thursday, July 28, 2022	18	0	0.0%
Aug-22	451,848	Monday, August 1, 2022	1	1,522	607	39.9%	Monday, August 8, 2022	18	0	0.0%
Sep-22	510,026	Thursday, September 1, 2022	1	1,522	708	46.5%	Thursday, September 1, 2022	18	0	0.0%
Oct-22	607,961	Saturday, October 1, 2022	1	1,522	817	53.7%	Tuesday, October 25, 2022	19	0	0.0%
Nov-22	659,669	Tuesday, November 1, 2022	1	1,522	916	60.2%	Tuesday, November 29, 2022	18	1,522	100.0%
Dec-22	718,532	Thursday, December 1, 2022	1	1,522	966	63.4%	Thursday, December 22, 2022	18	1,522	100.0%
Jan-23	698,057	Sunday, January 1, 2023	1	1,522	938	61.6%	Monday, January 30, 2023	9	0	0.0%
Feb-23	574,039	Wednesday, February 1, 2023	1	1,522	854	56.1%	Friday, February 24, 2023	8	0	0.0%
Mar-23	557,674	Wednesday, March 1, 2023	1	1,522	750	49.2%	Wednesday, March 1, 2023	8	0	0.0%
Apr-23	459,130	Saturday, April 1, 2023	1	1,522	638	41.9%	Monday, April 3, 2023	9	0	0.0%
May-23	405,570	Monday, May 1, 2023	1	1,522	545	35.8%	Monday, May 15, 2023	18	0	0.0%
Jun-23	356,906	Thursday, June 1, 2023	1	1,522	496	32.6%	Wednesday, June 7, 2023	19	0	0.0%
Annual	6,387,908	Annual Class Peak		1,522	729	47.9%	Annual System CP		1,522	100.0%
		Average 12 Monthly NCPs		1,522		47.9%	Average 12 Monthly CPs		254	16.7%
		Average Top 12 NCPs		1,522		47.9%	Average Top 12 CPs		799	52.5%
		Average Top 75 NCPs		1,522		47.9%	Average Top 75 CPs		591	38.8%
		Average Top 200 NCPs		1,522		47.9%	Average Top 200 CPs		700	46.0%
							Average 4CPs *		761	

* Monthly CPs for November, December, January and February

Table 33 – Area Lighting Class: Summary Statistics (Totals – kW)

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	4,187,513	Friday, July 1, 2022	1	15,724	5,628	35.8%	Thursday, July 28, 2022	18	358	2.3%
Aug-22	4,827,016	Monday, August 1, 2022	1	15,724	6,488	41.3%	Monday, August 8, 2022	18	358	2.3%
Sep-22	5,405,692	Thursday, September 1, 2022	1	15,724	7,508	47.7%	Thursday, September 1, 2022	18	358	2.3%
Oct-22	6,402,850	Saturday, October 1, 2022	1	15,724	8,606	54.7%	Tuesday, October 25, 2022	19	358	2.3%
Nov-22	6,916,219	Tuesday, November 1, 2022	1	15,724	9,606	61.1%	Tuesday, November 29, 2022	18	15,724	100.0%
Dec-22	7,518,970	Thursday, December 1, 2022	1	15,724	10,106	64.3%	Thursday, December 22, 2022	18	15,724	100.0%
Jan-23	7,312,291	Sunday, January 1, 2023	1	15,724	9,828	62.5%	Monday, January 30, 2023	9	358	2.3%
Feb-23	6,034,693	Wednesday, February 1, 2023	1	15,724	8,980	57.1%	Friday, February 24, 2023	8	358	2.3%
Mar-23	5,895,243	Wednesday, March 1, 2023	1	15,724	7,924	50.4%	Wednesday, March 1, 2023	8	358	2.3%
Apr-23	4,891,939	Saturday, April 1, 2023	1	15,724	6,794	43.2%	Monday, April 3, 2023	9	358	2.3%
May-23	4,359,874	Monday, May 1, 2023	1	15,724	5,860	37.3%	Monday, May 15, 2023	18	358	2.3%
Jun-23	3,860,078	Thursday, June 1, 2023	1	15,724	5,361	34.1%	Wednesday, June 7, 2023	19	358	2.3%
Annual	67,612,377	Annual Class Peak		15,724	7,718	49.1%	Annual System CP		15,724	100.0%
		Average 12 Monthly NCPs		15,724		49.1%	Average 12 Monthly CPs		2,919	18.6%
		Average Top 12 NCPs		15,724		49.1%	Average Top 12 CPs		8,425	53.6%
		Average Top 75 NCPs		15,724		49.1%	Average Top 75 CPs		6,323	40.2%
		Average Top 200 NCPs		15,724		49.1%	Average Top 200 CPs		7,418	47.2%
							Average 4CPs *		8,041	

* Monthly CPs for November, December, January and February

Table 34 – Street Lighting Class: Summary Statistics (Totals – kW)

4 NON-SYSTEM CLASS LOAD PROFILES

There are four classes that are termed "non-system loads" and are included in the cost-of-service analysis. These classes are considered non-system because they are transportation customers and are not included in PSE's measurement of system load. These classes include:

- Rate 449PV – Retail Wheeling Service Primary Voltage;
- Rate 449HV – Retail Wheeling Service High Voltage;
- Rate 459 – Back-Up Generation; and
- Special Contract – Retail Wheeling and Distribution Service.

4.1 Schedule 449 Primary Voltage Retail Wheeling Service

Since all of the customers under the Schedule 449 Primary Voltage (PV) are metered with interval load readings, the class hourly load profile was constructed by integrating their interval load data. The average loss factor estimated for the class was applied to the hourly loads. As listed in Table 4, the estimated average loss factor is 3.82%.

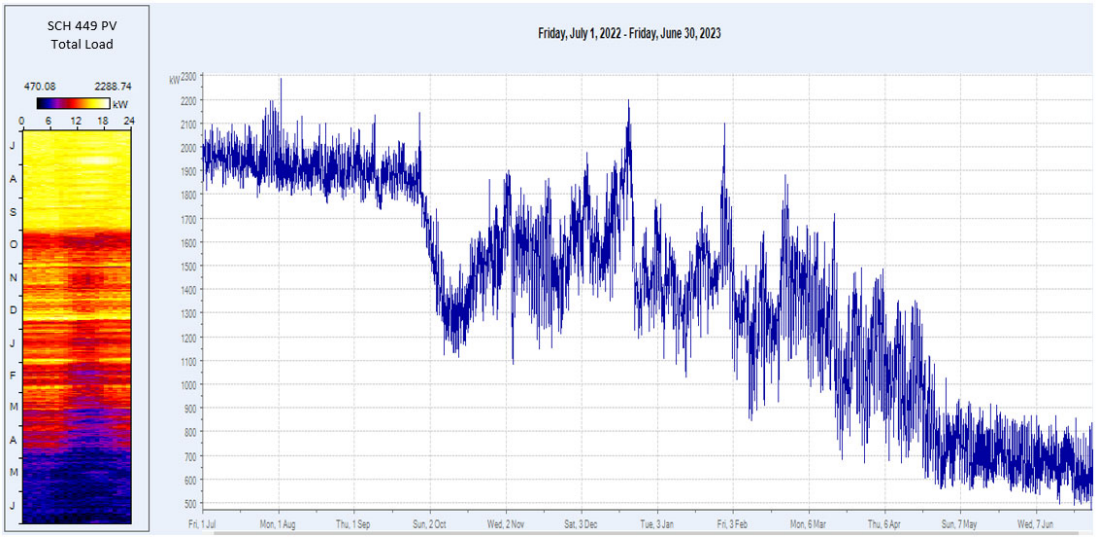

Figure 43 presents the total load for the Schedule 449PV class. The figure displays the EnergyPrint to the left of two-dimensional x-y plot. This class displays a relatively higher load in the winter months than the summer months. The Schedule 449PV class peak occurred on Tuesday, August 2 at 1 AM. The class peak demand was 2.3 MW.

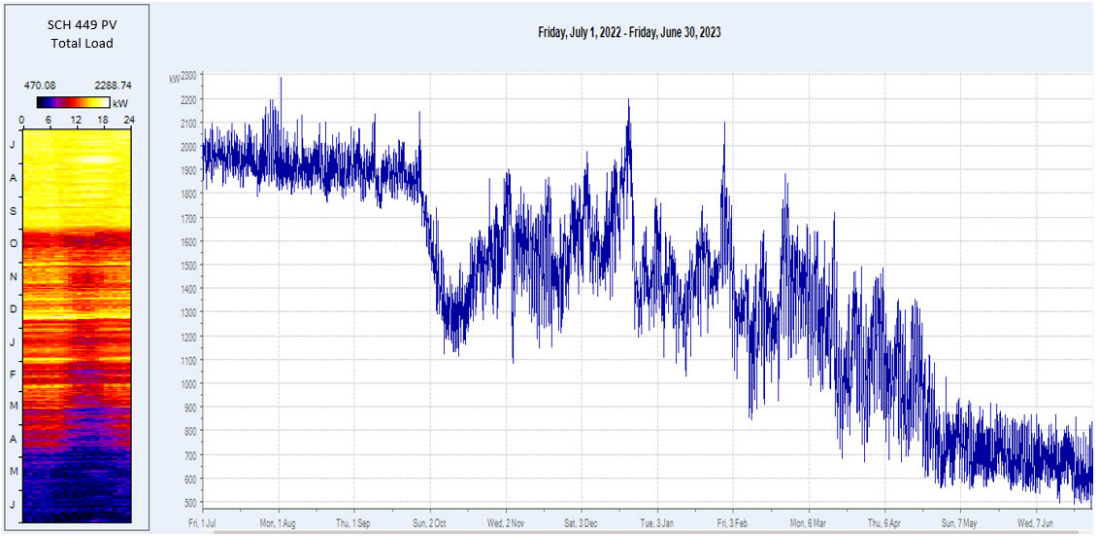

Figure 43 – Schedule 449PV: Class Total Load

Figure 44 presents the total Schedule 449PV class load for the system peak week of Sunday, December 18, 2022 through Saturday, December 24, 2022. The system peak occurred on Thursday December 22, 2022 at 6 PM. The class total load was about 2 MW at the time of the system coincident peak which was 88.3% of the class peak.

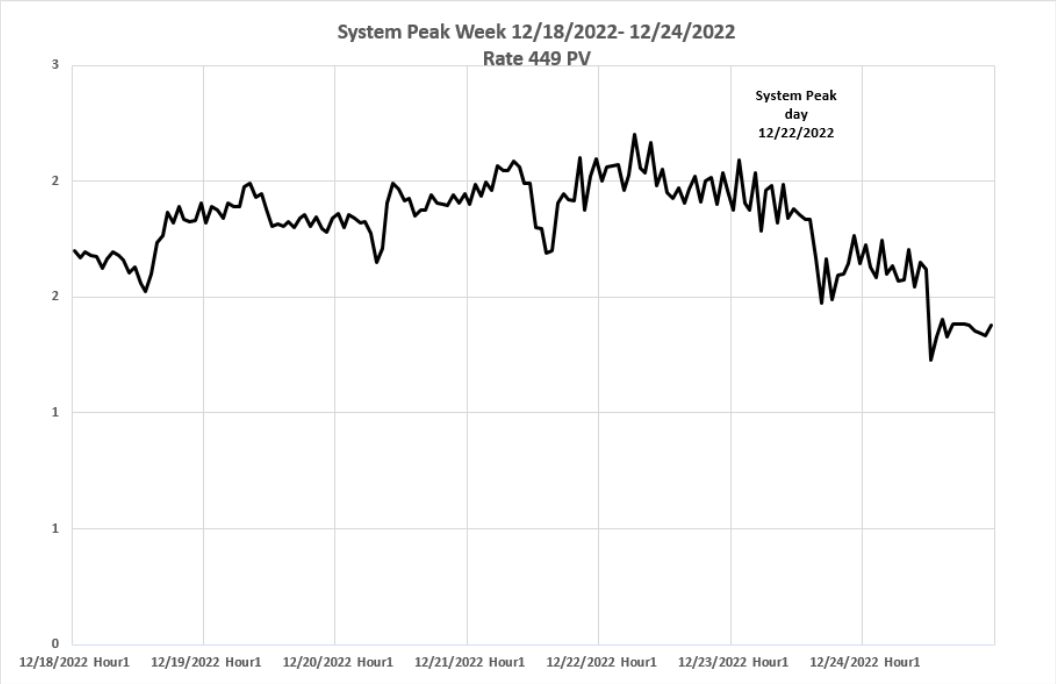

Figure 44 – Schedule 449PV: Total Load during System Peak Week

Figure 45 presents the monthly energy consumption, peak demand and load factor of the Schedule 449-PV class in charts. As reflected in the monthly energy charts, total electric energy uses of the retail wheeling primary voltage customers is slightly higher in the winter months compared to the rest of the year. This class also shows its monthly load factors about 80% or higher for all 12 months of the test year.

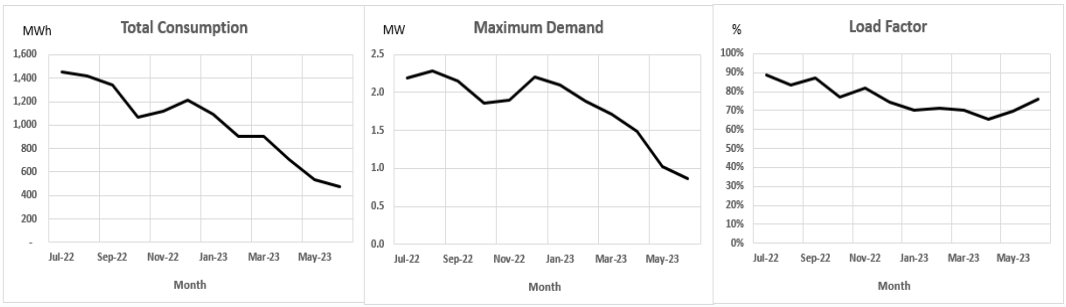

Figure 45 – Schedule 449PV: Class Monthly Energy, Demand and Load Factor

The achieved precision was perfect since the data for every customer in the class was available for the whole twelve-month period examined.

Table 35 presents summary statistics for the Schedule 449PV class load. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-

month average coincident peak contributions, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. The monthly NCP load factor ranges from a low of 65.7% in April, 2023 to a high of 89% in July, 2022. The load is fairly coincident with the system peak as shown by the system coincidence factors of over 80% in 11 of the 12 months in the study period.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	1,453,606	Friday, July 29, 2022	18	2,195	1,954	89.0%	Thursday, July 28, 2022	18	2,174	99.1%
Aug-22	1,420,192	Tuesday, August 2, 2022	1	2,289	1,909	83.4%	Monday, August 8, 2022	18	2,081	90.9%
Sep-22	1,344,264	Tuesday, September 27, 2022	13	2,145	1,867	87.1%	Thursday, September 1, 2022	18	1,961	91.4%
Oct-22	1,065,697	Wednesday, October 26, 2022	8	1,859	1,432	77.0%	Tuesday, October 25, 2022	19	1,476	79.4%
Nov-22	1,121,987	Thursday, November 3, 2022	1	1,902	1,558	81.9%	Tuesday, November 29, 2022	18	1,621	85.2%
Dec-22	1,217,096	Thursday, December 22, 2022	7	2,200	1,636	74.4%	Thursday, December 22, 2022	18	2,021	91.9%
Jan-23	1,094,070	Monday, January 30, 2023	8	2,101	1,471	70.0%	Monday, January 30, 2023	9	2,040	97.1%
Feb-23	900,064	Friday, February 24, 2023	8	1,880	1,339	71.2%	Friday, February 24, 2023	8	1,880	100.0%
Mar-23	899,919	Thursday, March 16, 2023	7	1,718	1,210	70.4%	Wednesday, March 1, 2023	8	1,601	93.2%
Apr-23	702,964	Wednesday, April 5, 2023	5	1,487	976	65.7%	Monday, April 3, 2023	9	1,250	84.1%
May-23	532,468	Monday, May 1, 2023	1	1,024	716	69.9%	Monday, May 15, 2023	18	834	81.4%
Jun-23	474,642	Sunday, June 4, 2023	21	868	659	75.9%	Wednesday, June 7, 2023	19	769	88.6%
Annual	12,226,969	Annual Class Peak		2,289	1,396	61.0%	Annual System CP		2,021	88.3%
		Average 12 Monthly NCPs		1,806		77.3%	Average 12 Monthly CPs		1,642	91.0%
		Average Top 12 NCPs		2,186		63.8%	Average Top 12 CPs		1,993	91.2%
		Average Top 75 NCPs		2,116		66.0%	Average Top 75 CPs		1,887	89.2%
		Average Top 200 NCPs		2,066		67.6%	Average Top 200 CPs		1,788	86.6%
							Average 4CPs *		1,891	

* Monthly CPs for November, December, January and February

Table 35 – Schedule 449PV Class: Summary Statistics (Totals – kW)

Since only one customer account is served under Schedule 449PV, no summary table is presented on a per-customer basis.

2.5 Schedule 449 High Voltage Retail Wheeling Service

All of the customers under the Schedule 449 High Voltage (HV) are metered with interval load readings. Therefore, the class hourly load profile is based on the population's actual load data. The average loss factor estimated for the class was applied to the hourly loads. As shown in Table 4, the estimated average loss factor is 1.78%.

Figure 46 presents the total load for the Schedule 449HV class. The figure displays the EnergyPrint to the left of two-dimensional x-y plot. Except the sudden drops in mid-April and May, this class load profile is fairly stable profile like 449PV's but at much higher loads. The Schedule 449HV class peak occurred on Thursday, August 18, 2022 at 1 PM. The class peak demand was 217.4 MW.

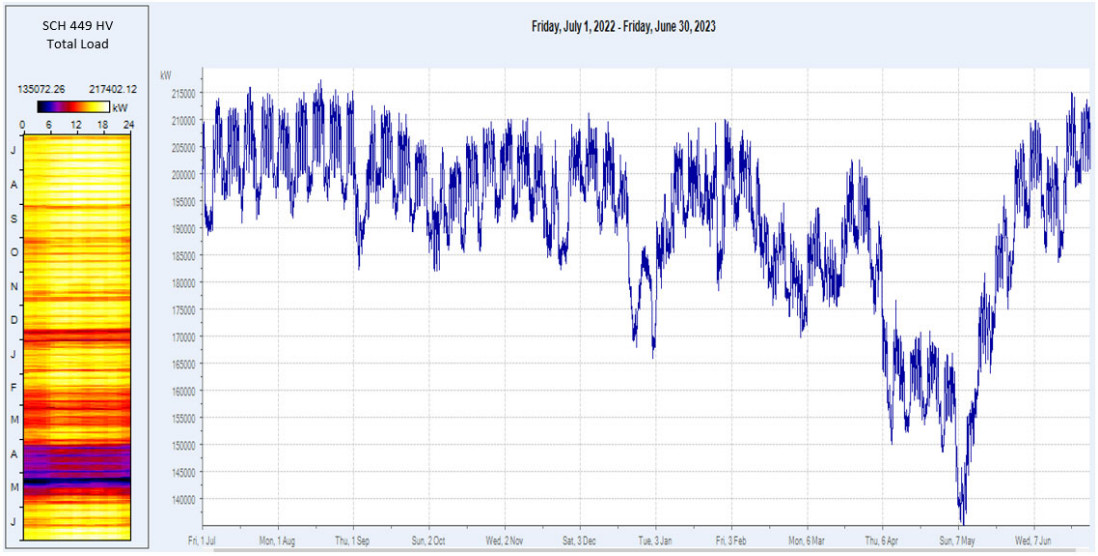

Figure 46 – Schedule 449HV: Class Total Load

Figure 47 presents the total Schedule 449HV class load for the system peak week of Sunday, December 18, 2022 through Saturday, December 24, 2022. The total class demand was 186 MW at the time of the system peak, which was 85.7% of the class peak demand.

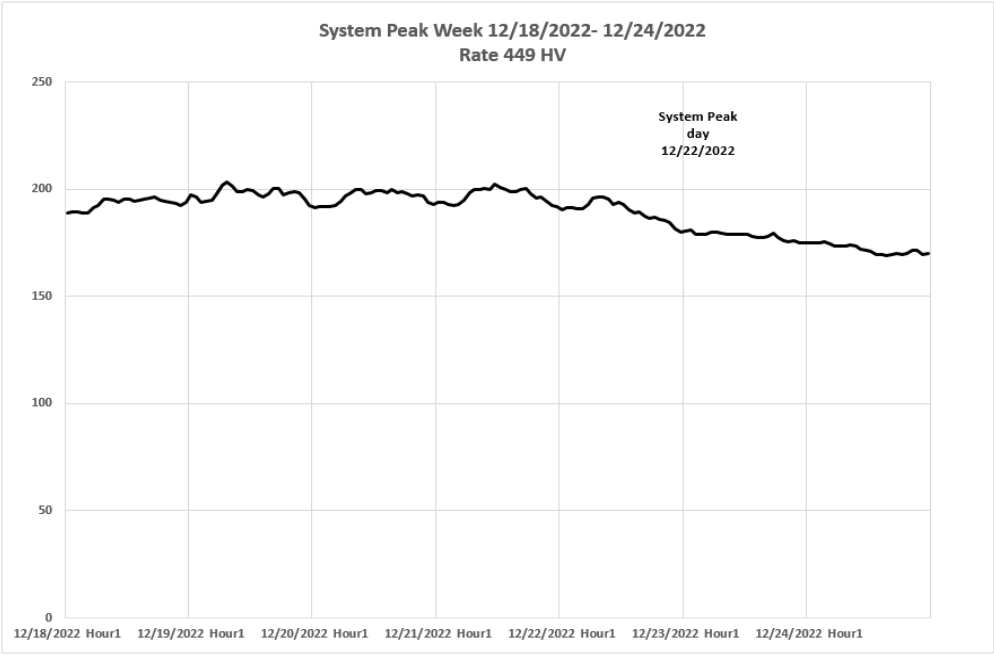

Figure 47 – Schedule 449HV: Total Load during System Peak Week

Figure 48 presents the monthly energy consumption, peak demand and load factors of the Schedule 449HV class in charts. As indicated by the monthly energy and maximum demand charts, the retail

wheeling high voltage customer class load is slightly higher in the mid-summer and mid-winter months. Monthly load factors are significantly higher than the Schedule 449PV's with 90% or more for 10 of the 12 months.

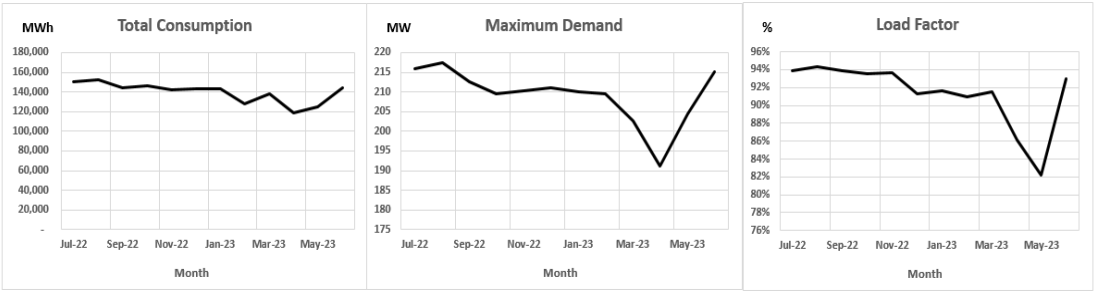

Figure 48 – Schedule 449HV: Class Monthly Energy, Demand and Load Factors

The achieved precision was perfect since the interval load data for the entire customer class was available for the full twelve-month period examined.

Table 36 presents summary statistics for the Retail Wheeling High Voltage class load. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-month average coincident peak contribution, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. The class displays very high monthly NCP load factors ranging from a low of 82.2% in May, 2023 to a high of 94.3% in August, 2022. The class load is highly coincident with the system peak with the monthly system coincident factors of over 90% for 10 of the 12 months in the study period.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	150,814,044	Wednesday, July 20, 2022	13	216,017	202,707	93.8%	Thursday, July 28, 2022	18	213,301	98.7%
Aug-22	152,579,233	Thursday, August 18, 2022	13	217,402	205,080	94.3%	Monday, August 8, 2022	18	210,174	96.7%
Sep-22	143,735,714	Tuesday, September 13, 2022	17	212,525	199,633	93.9%	Thursday, September 1, 2022	18	199,174	93.7%
Oct-22	145,918,721	Thursday, October 27, 2022	12	209,647	196,127	93.6%	Tuesday, October 25, 2022	19	203,689	97.2%
Nov-22	141,856,265	Friday, November 11, 2022	9	210,360	197,023	93.7%	Tuesday, November 29, 2022	18	205,562	97.7%
Dec-22	143,468,912	Tuesday, December 6, 2022	12	211,162	192,835	91.3%	Thursday, December 22, 2022	18	186,392	88.3%
Jan-23	143,183,823	Tuesday, January 31, 2023	9	210,010	192,451	91.6%	Monday, January 30, 2023	9	197,515	94.1%
Feb-23	128,137,006	Wednesday, February 1, 2023	10	209,519	190,680	91.0%	Friday, February 24, 2023	8	194,063	92.6%
Mar-23	138,021,953	Friday, March 24, 2023	9	202,648	185,513	91.5%	Wednesday, March 1, 2023	8	184,292	90.9%
Apr-23	118,609,767	Tuesday, April 4, 2023	12	191,222	164,736	86.1%	Monday, April 3, 2023	9	186,969	97.8%
May-23	124,932,883	Tuesday, May 30, 2023	11	204,332	167,921	82.2%	Monday, May 15, 2023	18	175,279	85.8%
Jun-23	143,982,272	Thursday, June 22, 2023	13	215,086	199,975	93.0%	Wednesday, June 7, 2023	19	206,641	96.1%
Annual	1,675,240,592	Annual Class Peak		217,402	191,238	88.0%	Annual System CP		186,392	85.7%
		Average 12 Monthly NCPs		209,161		91.4%	Average 12 Monthly CPs		196,921	94.1%
		Average Top 12 NCPs		216,022		88.5%	Average Top 12 CPs		193,552	89.6%
		Average Top 75 NCPs		214,471		89.2%	Average Top 75 CPs		194,055	90.5%
		Average Top 200 NCPs		213,287		89.7%	Average Top 200 CPs		197,416	92.6%
							Average 4CPs *		195,883	

* Monthly CPs for November, December, January and February

Table 36 – Schedule 449HV Class: Summary Statistics (Totals – kW)

Since only eleven customers are served under Schedule 449HV, no summary table is presented on a per-customer basis.

2.6 Schedule 459 – Back-Up Generation

Schedule 459 Back-Up Generation class hourly loads were calculated by integrating the class customers' interval load data. There were only three customers under Schedule 459. The average loss factor estimated for the class was applied to the hourly loads. As listed in Table 4, the estimated average loss factor is 1.78%.

Figure 49 presents the total load for the Schedule 459 class. The figure displays the EnergyPrint to the left of two-dimensional x-y plot. The class energy use is significantly lower in April compared to rest of the year. This is consistent with other years when usage go significantly low in summer for a certain period of time. The Schedule 459 class peak occurred on Tuesday, August17, 2022 at 12 PM. The class peak demand was 41.7 MW.

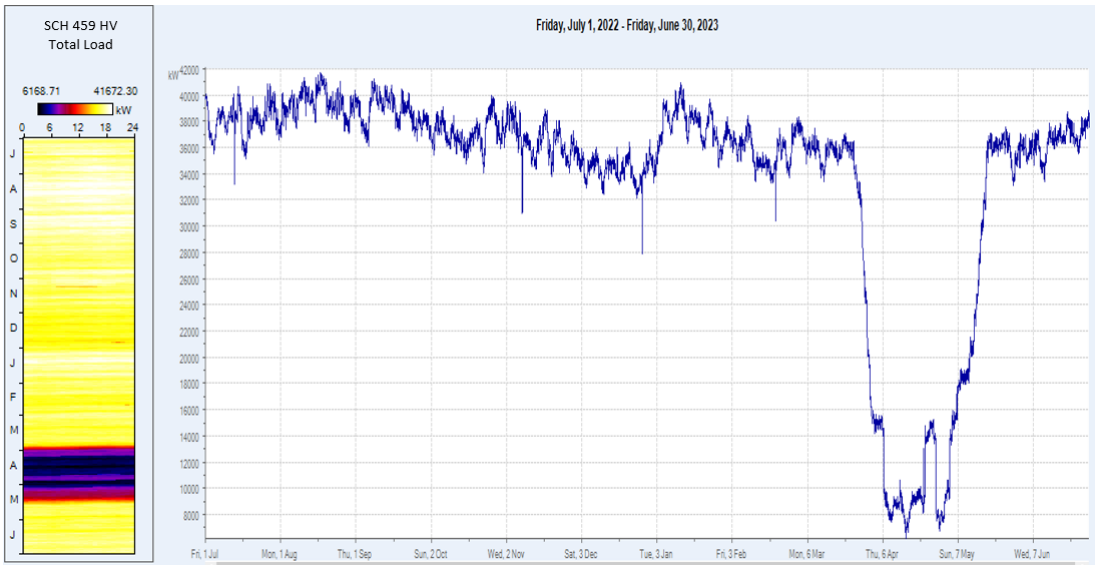

Figure 49 – Schedule 459: Class Total Load

Figure 50 presents the total Schedule 459 class load for the system peak week of Sunday, December 18, 2022 through Saturday, December 24, 2022. The class demand was 35.7 MW at the time of the system peak which was 85.6% of the class peak.

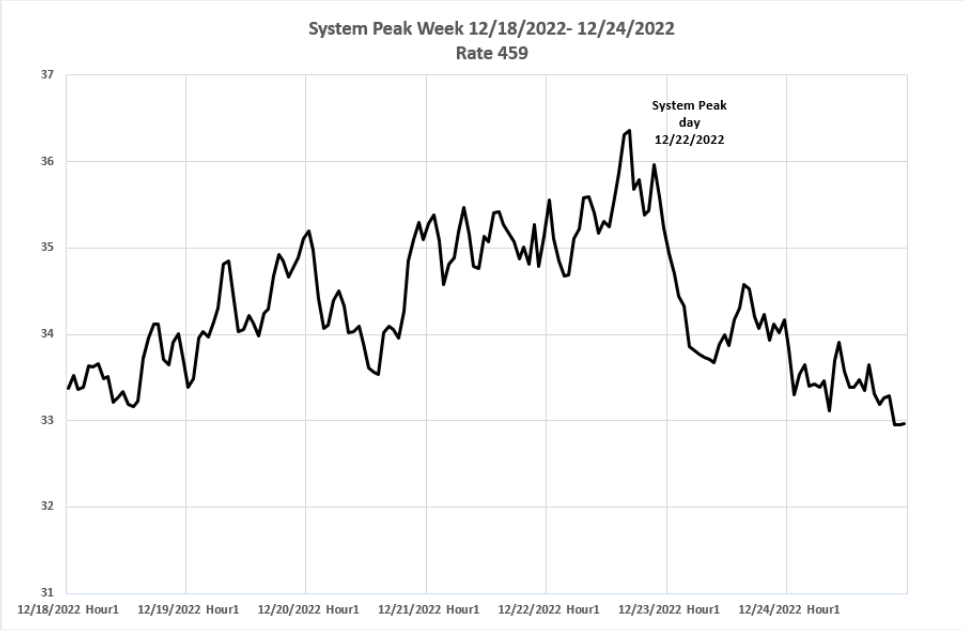

Figure 50 – Schedule 459: Total Load during System Peak Week

Figure 51 illustrates the monthly energy consumption, peak demand and load factor of the Schedule 459 class. The monthly energy consumption and demand charts show a slight summer-seasonality of the class load.

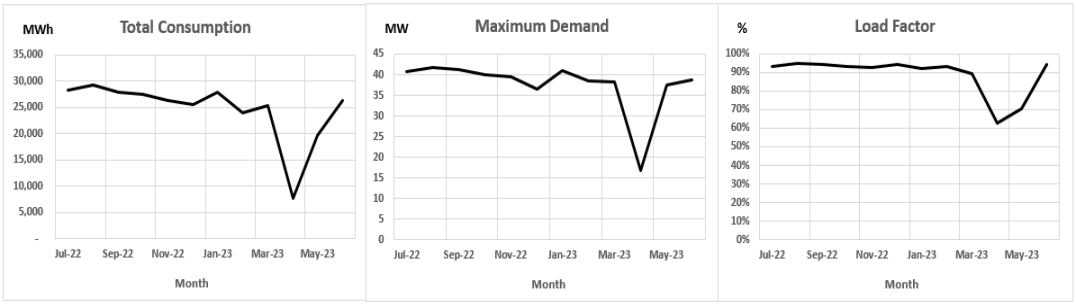

Figure 51 – Schedule 459: Class Monthly Energy, Demand and Load Factor

The achieved precision was perfect since the interval load data for all of the customers in the class were available for the full twelve-month period examined.

Table 37 presents summary statistics for the Schedule 459 class load. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-month average coincident peak contribution, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. The monthly NCP load factors are high

across the study period being over 90% for nine out of twelve months. The monthly system-coincidence factors are also over 90% for 9 of 12 months in the study period.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	28,336,960	Tuesday, July 26, 2022	17	40,839	38,087	93.3%	Thursday, July 28, 2022	18	40,184	98.4%
Aug-22	29,347,469	Wednesday, August 17, 2022	12	41,672	39,446	94.7%	Monday, August 8, 2022	18	39,728	95.3%
Sep-22	27,926,519	Thursday, September 8, 2022	14	41,236	38,787	94.1%	Thursday, September 1, 2022	18	39,633	96.1%
Oct-22	27,619,496	Wednesday, October 26, 2022	20	39,958	37,123	92.9%	Tuesday, October 25, 2022	19	38,908	97.4%
Nov-22	26,300,256	Thursday, November 3, 2022	16	39,527	36,528	92.4%	Tuesday, November 29, 2022	18	36,647	92.7%
Dec-22	25,567,642	Saturday, December 31, 2022	4	36,549	34,365	94.0%	Thursday, December 22, 2022	18	35,681	97.6%
Jan-23	27,938,864	Thursday, January 12, 2023	20	40,892	37,552	91.8%	Monday, January 30, 2023	9	36,057	88.2%
Feb-23	23,973,284	Thursday, February 9, 2023	9	38,418	35,675	92.9%	Friday, February 24, 2023	8	36,395	94.7%
Mar-23	25,458,735	Thursday, March 2, 2023	9	38,309	34,219	89.3%	Wednesday, March 1, 2023	8	37,565	98.1%
Apr-23	7,617,477	Saturday, April 1, 2023	1	16,901	10,580	62.6%	Monday, April 3, 2023	9	14,948	88.4%
May-23	19,738,558	Friday, May 26, 2023	17	37,528	26,530	70.7%	Monday, May 15, 2023	18	27,918	74.4%
Jun-23	26,295,778	Thursday, June 29, 2023	16	38,817	36,522	94.1%	Wednesday, June 7, 2023	19	35,616	91.8%
Annual	296,121,037	Annual Class Peak		41,672	33,804	81.1%	Annual System CP		35,681	85.6%
		Average 12 Monthly NCPs		37,554		90.0%	Average 12 Monthly CPs		34,940	93.0%
		Average Top 12 NCPs		41,518		81.4%	Average Top 12 CPs		35,425	85.3%
		Average Top 75 NCPs		41,124		82.2%	Average Top 75 CPs		35,029	85.2%
		Average Top 200 NCPs		40,809		82.8%	Average Top 200 CPs		35,395	86.7%
							Average 4CPs *		36,195	

* Monthly CPs for November, December, January and February

Table 37 – Schedule 459 Class: Summary Statistics (Totals – kW)

Since only three customers are served under Schedule 459, no summary table is presented on a per-customer basis.

2.7 Special Contract – Retail Wheeling and Distribution Service

Special Contract class hourly loads were calculated by integrating the interval load data collected from all the metering device locations belonged to the Special Contract customer.[7] As listed in Table 4, the estimated average loss factor is 3.28%.

Figure 52 presents the total load for the Special Contract class. The figure displays the EnergyPrint to the left of two-dimensional x-y plot. The class energy use tends to be higher in the winter months but picks up again in June. The Special Contract class peak occurred on system peak day of December 22, at 8 AM. The class peak demand was 63.2 MW.

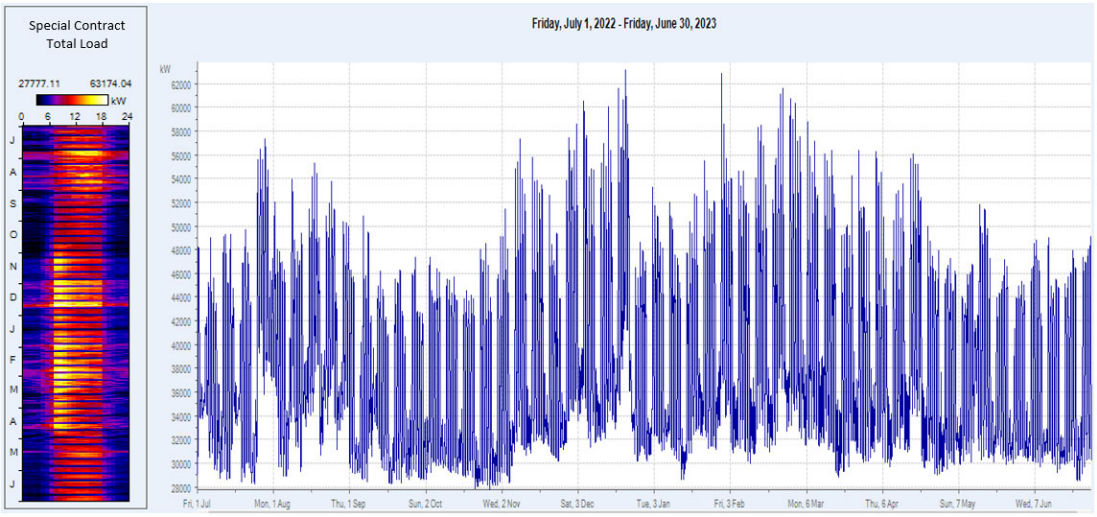

Figure 52 – Special Contract: Class Total Load

Figure 53 presents the Special Contract class for the system peak week of Sunday, December 18, 2022 through Saturday, December 24, 2022. The class demand was 55.7 MW at the time of the system peak which was 88.2% of the class peak.

[7] Only one customer is served under a special contract since April 1, 2019.

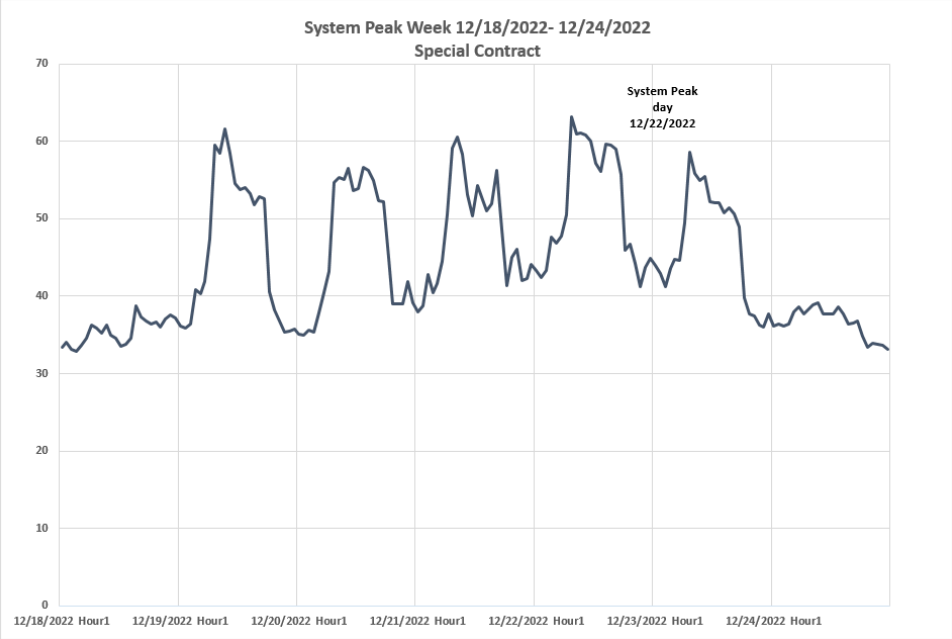

Figure 53 – Special Contract: Total Load during System Peak Week

Figure 54 illustrates the monthly energy consumption, peak demand and load factor of the Special Contract class. The monthly energy consumption and demand charts show some summer and winter seasonality of the class load.

Figure 54 – Special Contract: Class Monthly Energy, Demand and Load Factor

The achieved precision was perfect since the interval load data for all of the metering device locations in the class were available for the full twelve-month period examined.

Table 38 presents summary statistics for the Special Contract class load. The table displays monthly energy use, timing of the class peak demand, magnitude of the class peak demand, average demand, load factor based on the class peak demand, timing of the system peak and class load at the time of system peak and the coincidence factor calculated as the class system-coincident load divided by the class peak. In addition, the table displays other summary characteristics, such as 12-month and 4-month average coincident peak contribution, and average values of the top 12, 75 and 200 class peaks and the class loads at top 12, 75 and 200 system peak hours. The monthly NCP load factors range

from a low of 60.8% in January, 2023 to a high of 73.9% in June, 2023. The monthly system-coincidence factors of class load are over 90% for seven of the twelve months in the study period.

		Class Peak Demand					Class Demand at System Peak Hour			
Month	Monthly Energy Use (kWh)	Date of Class Peak	Time of Class Peak	Class Peak Demand (kW)	Average Demand (kW)	Load Factor (%)	Date of System Peak	Time of System Peak	Class Demand @ System Peak (kW)	Coincidence Factor (%)
Jul-22	28,416,940	Thursday, July 28, 2022	14	57,294	38,195	66.7%	Thursday, July 28, 2022	18	52,525	91.7%
Aug-22	29,362,854	Wednesday, August 17, 2022	15	55,317	39,466	71.3%	Monday, August 8, 2022	18	51,867	93.8%
Sep-22	25,417,562	Tuesday, September 6, 2022	15	50,796	35,302	69.5%	Thursday, September 1, 2022	18	44,738	88.1%
Oct-22	25,828,443	Wednesday, October 26, 2022	9	48,522	34,716	71.5%	Tuesday, October 25, 2022	19	34,492	71.1%
Nov-22	27,284,258	Tuesday, November 29, 2022	9	57,441	37,895	66.0%	Tuesday, November 29, 2022	18	50,258	87.5%
Dec-22	30,285,723	Thursday, December 22, 2022	8	63,174	40,707	64.4%	Thursday, December 22, 2022	18	55,697	88.2%
Jan-23	28,418,226	Monday, January 30, 2023	8	62,850	38,197	60.8%	Monday, January 30, 2023	9	62,375	99.2%
Feb-23	27,118,246	Friday, February 24, 2023	9	61,586	40,355	65.5%	Friday, February 24, 2023	8	60,524	98.3%
Mar-23	29,062,816	Wednesday, March 1, 2023	9	60,278	39,063	64.8%	Wednesday, March 1, 2023	8	58,447	97.0%
Apr-23	27,204,853	Monday, April 3, 2023	9	56,285	37,785	67.1%	Monday, April 3, 2023	9	56,285	100.0%
May-23	27,478,795	Monday, May 15, 2023	14	51,819	36,934	71.3%	Monday, May 15, 2023	18	48,178	93.0%
Jun-23	26,084,912	Thursday, June 29, 2023	15	49,052	36,229	73.9%	Wednesday, June 7, 2023	19	39,216	79.9%
Annual	331,963,625	Annual Class Peak		63,174	37,895	60.0%	Annual System Peak		55,697	88.2%
		Average 12 Monthly NCPs		56,201		67.4%	Average 12 Monthly CPs		51,217	91.1%
		Average Top 12 NCPs		61,457		61.7%	Average Top 12 CPs		54,911	89.3%
		Average Top 75 NCPs		58,503		64.8%	Average Top 75 CPs		53,138	90.8%
		Average Top 200 NCPs		56,365		67.2%	Average Top 200 CPs		50,587	89.7%
							Average 4CPs *		57,214	

* Monthly CPs for November, December, January and February

Table 38 – Special Contract Class: Summary Statistics (Totals – kW)

Since only one customer is served under Special Contract, no summary table is presented on a per-customer basis.

5. APPENDIX A – VALIDATION, EDITING AND ESTIMATION (VEE) APPROACH

This section highlights the validation, editing, and estimation (VEE) approaches used for analyses. The VEE process covers each individual site's load data and how to validate the load data that exists, identify bad data for editing, and estimate missing intervals with appropriate values. The major aspects of the VEE process are listed below:

- Identifying suspect outages for removal;
- Identifying extreme spikes and valleys;
- Using weather regression models and interpolation to estimate values for missing data; AND
- Validating the load data against the associated billing data.

5.1 Outages

This step in the VEE process is to attempt to identify suspect outages in the load data. Suspect outages could be a result of bad metering, a failed meter, or poor meter data management estimation. Trying to identify these outages is key in ensuring that load data is being represented well. If suspect outages have been identified, the user can choose to remove this load data and attempt to estimate the

outages with actual data or to remove the load profile from analysis depending on how much load data has been reset to missing.

5.2 Outlier Identification

This step in the VEE process is to attempt to identify outliers for both peaks and valleys. Outliers could be a result of bad metering, a failed meter, or poor meter data management estimation. It could also be a result of an unusual circumstance at the site's location resulting in a value that is not typical. It will be up to the user to determine if the unusual circumstance should remain for analysis purposes or if it should be removed for an expected value. Trying to identify outliers is key in ensuring that load data is being represented well, especially if the peak outlier is extreme enough to have impacts on allocators used in rate design and pricing. If outliers have been identified, those values were then set to missing. The VEE process uses multiple methods to identify outliers and then remove them or reset them to missing.

5.3 Time-Temperature Regression Modelling

Another important aspect of the VEE process is to attempt to fill in the missing data with appropriate estimated values. The importance of estimating the missing values is to attempt to have as complete load data as possible for each sample site. There will be instances that a site may have too much missing data in order to do effective estimation. The user can choose to use the data that does exist for this data or to remove the site completely from the analysis. For those that have enough non-missing validated intervals to do regression modeling, different methods can be used for estimation. Weather regression models are utilized in the modeling techniques for longer missing time frames. For shorter time frames (which can be defined by the user), interpolation is utilized to fill in those values as shorter time frames will be best represented by the non-missing intervals around it. For estimation, the best practice is to not estimate new peaks, so the user can prevent the software from creating an estimate that is greater than the non-missing max value for the sample site. In addition to these two methods, any validated sites can be used to create an average customer shape that could then be used to fill in the gaps for the sites that do not have enough load data to effectively estimate their own missing loads through regression modeling or interpolation.

This analyses uses a time-temperature modelling strategy as the fundamental basis to build models for use to fill gaps and missing data. The approach develops a mathematical model that represents the relationship between energy usage and temperature. Using this model, intervals with missing load data can be predicted applying the temperature of that hour to the model of best fit for that hour. This normalization analysis recognizes that each customer reacts differently to varying heating and cooling degree days, and each customer has unique space conditioning characteristics. Buildings with more efficient heating or cooling equipment, radiant barriers, more insulation, and efficient windows will consume less energy because they will require less heating and/or cooling.

The simplest model where the specifications is such that energy consumptions depends on either heating or cooling degree days only is shown in Equation 1.

Equation 1 – Basic Model

$$U_i = \alpha + \beta * DD_i(\tau) + e$$

Where;

U_i = average daily consumption in interval i.
$DD_i(\tau)$ = average degree days in interval i, based on reference temperature
α,β = parameters to be estimated to minimize e.
e = a random error term.

The base model reflects that a customer's energy usage is equal to some base level α, and a linear function between a reference temperature τ, and the outside temperature. The constant proportionality, β, represents a customer's effective heat-loss or heat-gain rate. As mentioned, the model recognizes that each customer has unique space conditioning operating characteristics. To capture these unique space conditioning characteristics, the modelling runs regressions for a range of heating and cooling reference temperatures (i.e., temperatures at which users tend to turn on heating or cooling equipment) against usage. The model chosen to represent a customer's energy use is the model that best linearizes the relationship between usage and degree days. A degree day is the difference between the recorded temperature for a period (could be 15 minute, hourly, or daily depending on how the modelling approach is being applied) and the point at which an occupant will act in response to temperature (either turning on the heating or air conditioning). For example, if a building occupant will turn on the AC at 74°F and the recorded temperature for an hour was 85°F, the total cooling degrees would be 11. A cooling degree day is the sum of cooling degrees for each day. For each customer, an optimal model based on a unique reference temperature (τ is identified by the minimum mean squared error (MSE) of the modelling regression) is selected. Models for each site are built by DOW and hour. Users can specify to use individual days or weekday/weekend for the model DOW.

When the model regression is applied to a customer's heating characteristics, it is referred to as the heating only model (HOM). When the model regression is applied to a customer's cooling characteristics, it is referred to as the cooling only model (COM). When the model regression model is applied to both heating and cooling characteristics, it is referred to as the heating and cooling model (HCM). One example of a customer that would use the HCM would be a customer that had electric heating as well as air conditioning. For this analysis all customers used an HOM because we are conducting a gas analysis where cooling is not relevant.

The analysis identifies the optimum HDD and/or CDD for each customer, which will be used to fill in gaps in the load data file using actual temperature for that DOW.

5.4 Metered to Billing Comparison

Validating the load data is an important part of the VEE process, whether it is load data that fully exists for any sample point or if estimation was used to fill in gaps. The main goal of the bill-to-meter process is to be a validation check on the load data when comparing to a known, true value. This value is often the billed usage obtained for the same sample point. The user can compare the load data on a bill-by-bill basis or at an aggregate level for the study frame being compared. Whether the user uses the actual bill read dates and days in the billing cycle to define the start and end frames for comparison or a read cycle definition to define these time frames, the process ensures that the

load data being compared to the billing data are examining an appropriate time frame allowing for an "apples-to-apples" comparison.

When comparing the billing usage against the load data, the ratio between the two are compared to a defined threshold. The calculation of this comparison is:

$$1 - (RatioThreshold - 1) < \frac{\sum LoadData_i}{\sum BillData_i} < RatioThreshold$$

Where,

- *RatioThreshold* is the percent difference the load data is allowed to be within to be considered "ok". This value should be greater than 1. If the allowed threshold is 5%, then this value should be set to 1.05;
- *LoadData* is the sum of the interval usage for the given time frame i;
- *BillData* is the sum of the billing usage for the given time frame i. It could just be the billed usage as is without doing any summation; and
- *i* is the representation of a given bill or timeframe. The user could choose to sum all i bills for comparison or do each of them individually.

6 APPENDIX B – ANALYSIS APPROACH

The analyses approach follows the principals of model-based statistical sampling ("MBSS") as the basis for analysis. MBSS techniques have been used to create a very efficient and flexible structure for collecting data on countless energy efficiency evaluations, demand response evaluations, and interval load data analyses, e.g., load research and end-use metering, projects. This project uses near population-based samples requiring little or no post-stratification.

6.1 Background

Conventional methods are documented in standard texts such as Cochran's *Sampling Techniques*.[8] MBSS is grounded in theory of model-assisted survey sampling developed by C.E. Sarndal and others.[9] [10] MBSS methodology has been applied in load research for more than fifty years and in energy efficiency evaluation for more than thirty years. This fusion of theory and practice has led to important advances in both model-based theory and interval load data collection practice, including the use of the error ratio for preliminary sample design, the model-based methodology for efficient stratified ratio estimation, and effective methods for domains estimation.

MBSS and conventional methodologies are currently taught in the Association of Edison Illuminating Companies' *Advanced Methods in Load Research* seminar. MBSS methodology is also documented in *The California Evaluation Framework.*[11] MBSS has been used successfully for decades in countless load research and program evaluation studies. It has also been examined in public utility hearings and in at least two EPRI studies.

6.2 The Role of the Statistical Model

MBSS uses a statistical model to guide the planning and the sample design. The parameters of the model, especially the error ratio, are used to represent prior information about the population to be sampled. The model describes the nature of the variation in the relationship between any target *y variable* of the study, in our case the normalized daily consumption of the customer, and one or more *x variable*s that can be developed from known billing data and other supporting information. The *x variable* is usually a measure of the size of the customer, e.g., annual use, and assumes good information is available in the billing to support the analysis. The model is used to help choose the sample size *n*, to assess the expected statistical precision of any sample design, and to help formulate a sample design that is efficiently stratified for ratio estimation using case weights.

The model is used as a *guide* to the sample design, but the results of the study itself are *not* strongly dependent on the accuracy of the model.[12] Once the sample design is selected, the subsequent analysis of the data is based only on the sample design and not on the model used to develop the

[8] *Sampling Techniques*, by W. G. Cochran, 3rd. Ed. Wiley, 1977.
[9] *Model Assisted Survey Sampling*, by Carl Erik Sarndal, Bengt Swensson and Jan Wretman, Springer-Verlag, 1992.
[10] Wright, R. L. (1983), "Finite population sampling with multivariate auxiliary information," *Journal of the American Statistical Association*, **78**, 879-884.
[11] The report can be downloaded from the webaccount, http://www.calmac.org/calmac-filings.asp
[12] Other methods, called model-dependent sampling, are much more dependent on the accuracy of the model. Such methods are not commonly used in load research applications since they would be more difficult to defend than MBSS and conventional methods.

sample design. The resulting estimates will be essentially unbiased in repeated sampling and the confidence intervals will also be valid, provided that the sample design has been followed to select the sample customers. The results will be consistent with traditional sampling theory as found in texts such as Cochran's *Sampling Techniques* and consistent with standard load and market research practice.

6.3 Stratified Ratio Estimation

We assume that the data collected and analyzed in the study is for a given population of *N* premises in a given customer class. In this study, daily therm use will be the unit of measure. We let *y* denote any customer characteristic to be determined from the customer's interval load data, i.e., weather normalized daily usage, and we let *x* denote any suitable characteristic of the customer that is known from billing system data such as annual use or daily use.

We define the population ratio *B* by the equation:

$$B = \frac{\sum_{i=1}^{N} y_i}{\sum_{i=1}^{N} x_i}.$$

Here the summations are over the entire *N* units (e.g., customers) in the target population. We note that the population mean or total of *y* is equal to *B* times the population mean or total of *x.* The latter is assumed to be known from the billing data.
We assume that a sample of *n* customers is selected following a stratified sample design. But in this case, we have near population-based samples requiring little or no post-stratification. For each sample customer we define the case weight *w* to be equal to the number of customers in the target population within the stratum containing the given customer divided by the number of customers in the sample within the given stratum. Here again, by using near population-based sample we simply construct the weight as the population count (N) divided by customers with available daily data (n). In most instances the weight will be close to 1.0. Typically, the case weight is used to avoid any bias that might otherwise arise from the different sampling fractions used from one stratum to another.
Using the case weight, we define the combined ratio estimator of *B* by the equation: [13]

$$b = \frac{\sum_{i=1}^{n} w_i\, y_i}{\sum_{i=1}^{n} w_i\, x_i}$$

Then, if desired, the population mean or total of *y* can be estimated as *b* times the population mean or total of *x,* known from the billing data.

[13] This equation gives the same result as the conventional stratum-weighted equation:

$$b = \frac{\sum_{h=1}^{L} N_h\, \bar{y}_h}{\sum_{h=1}^{L} N_h\, \bar{x}_h}.$$

Using the case weights, we calculate the relative precision at the 90% level of confidence in three steps:

1. Calculate the sample residual $e_i = y_i - bx_i$ for each unit in the sample.
2. Calculate[14] $se(b) = \frac{\sqrt{\sum_{i=1}^{n} w_i (w_i - 1) e_i^2}}{\sum_{i=1}^{n} w_i x_i}$.
3. Calculate $rp = \frac{1.645\ se(b)}{b}$.

A 90% confidence interval for *B* is calculated using the equation $b \pm rp\ b$. A confidence interval for the mean or total can be calculated in a similar way. The total is calculated by multiplying the ratio by the known population total from the billing system (Equation 2).

Equation 2 – Estimating Totals

$$\hat{Y} = \hat{B}\ X$$

[14] The conventional equation is $se(b) = \frac{1}{\sum_{h=1}^{L} N_h \bar{x}_h} \sqrt{\sum_{h=1}^{L} N_h^2 \left(1 - \frac{n_h}{N_h}\right) \frac{s_h^2(e)}{n_h}}$ where $s_h^2(e) = \frac{1}{n_h - 1} \sum_{i=1}^{n_h} (e_i - \bar{e})^2$. Our equation assumes that $\frac{1}{n_h - 1} \sum_{i=1}^{n_h} (e_i - \bar{e})^2$ is approximately equal to $\frac{1}{n_h} \sum_{i=1}^{n_h} (e_i)^2$ in each stratum.