CASCADE NATURAL GAS LOAD STUDY PROGRESS REPORT AND WRITTEN PLAN

August 2021

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EXECUTIVE SUMMARY

The purpose of this document is to provide a written plan and create a set of standards that would be followed to complete a load study that is applied to generate a design day allocator for Cascade's cost-of-service study. In Docket No. UG-200568, the Washington Utilities and Transportation Commission ("Commission") required Cascade Natural Gas Corporation ("Cascade") to file a load study by September 21, 2022.

Cascade is currently installing metering equipment capable of electronically capturing and reading daily data on a per customer level that is transmitted and stored for subsequent use in a load study analysis. The recent progress of the initial fixed network installation resulted in:

- A fixed network covering 25 percent of Cascade's Washington service meters using 40 devices on Cascade's owned facilities as of June 2021.
- A propagation study identifying the need to install an additional 330 devices to ensure 98 percent coverage in Cascade's service territory in the state of Washington.
- Estimated completion of Cascade's fixed network installation by December 31, 2022.

The objective of the load study is to quantify and assign peak responsibility by comparing individual rate schedule demands to system demands. To determine whether the data collected is accurate for a load study, Cascade must measure and analyze individual customer usage at the daily level to determine representative sample size for each rate class and geographic location and apply analysis techniques. Cascade is committed to put in place the required infrastructure and personnel to collect, analyze, and report on this data.

INTRODUCTION

The purpose of this document is to provide a written plan that discusses the fixed network equipment installation process, the gathering and storage of fixed network data, the data sources utilized, analysis techniques, supporting documentation, and provides a timeline to complete a load study that is applied to generate a design day allocator for Cascade's cost of service study. The objective of the load study is to quantify and assign peak responsibility by comparing individual rate schedule demands to system demands. Once Cascade has performed its load study for all firm customer groups, Cascade will be able to assign costs to serve each class or customer based on their contribution to the system peak within a cost-of-service study using a design day allocator.

To begin collecting the data required for a load study, Cascade determined that it needed to install equipment to collect and transmit daily customer usage data. Specifically, Cascade needed to install metering equipment capable of electronically capturing and transmitting data, which are called Encoder Receiver Transmitters ("ERTs") and develop meter reading capabilities to receive the data and transmit and store the data for subsequent use in the load study analysis. Cascade determined that it would develop a fixed network to provide the needed meter reading capabilities. A fixed network is constructed with collectors and repeaters, which are devices that relay the data from the ERTs and transmits the data over cellular and Cascade support connections back to Cascade's fixed network servers, where the individual data is compiled to a data management system ("DMS"), so business applications and software programs can analyze the data.

FIXED NETWORK

The following section provides Cascade's fixed network equipment installations that are completed and the status of ongoing equipment installation to complete the network, the fixed network meter coverage, and timelines. Further details of the fixed network are provided within a Gantt chart in “Exhibit A – Cascade Fixed Network and Load Study Schedule.”

COMPLETED EQUIPMENT INSTALLED AND COVERAGE

In the fall of 2020, Cascade began its initial installation of devices at Cascade’s owned locations to enable use of a fixed network for gathering daily meter read data from Cascade meters equipped with ERTs. This initial installation of the fixed network continued until June 30, 2021, with a total of 40 devices installed. Further installation of fixed network equipment on third party owned locations is described in the next section of this document. The result of this initial installation is detailed by city, total meter count, total meter reads, and those reads broken out by customer class in the below Table 1:

Table 1: Meter Data from Fixed Network Installation – June 2021

City	Total Meter Count	Meters Read by the Fixed Network			
		Total	By Customer Class		
			Residential	Commercial	Industrial
ABERDEEN	1,807	1,575	1,220	352	3
ANACORTES	6,871	17	15	2	
BELLINGHAM	30,920	8,872	7,663	1,199	10
BREMERTON	17,532	1,570	1,472	98	
BURLINGTON	4,803	2,546	2,042	480	24
DEMING	38	38	25	13	
EAST WENATCHEE	467	465	332	131	2
EVERSON	1,318	110	86	23	1
FERNDALE	6,297	39	39		
GRANDVIEW	1,253	179	130	39	10
HOQUIAM	1,303	1,255	1,100	149	6
KALAMA	271	262	200	59	3
KELSO	649	258	123	130	5
KENNEWICK	10,157	2,764	1,838	926	
LONGVIEW	2,378	1,463	920	536	7
LYNDEN	7,359	2,461	2,280	176	5
MOSES LAKE	1,140	887	540	341	6
MOUNT VERNON	12,110	7,964	6,848	1,107	9
OTHELLO	1,426	1,261	988	265	8
PASCO	13,382	1,437	1,299	135	3
QUINCY	146	103	38	60	5
RICHLAND	9,328	465	391	74	
SEDRO WOOLLEY	4,270	3,941	3,558	370	13
SILVERDALE	4,525	1,567	1,106	461	
SUMAS	518	203	170	31	2
SUNNYSIDE	2,594	2,145	1,652	476	17
TOPPENISH	1,218	936	730	200	6
UNION GAP	1,059	56	16	38	2
WALLA WALLA	10,762	685	336	318	4
WAPATO	467	464	344	111	9
WENATCHEE	1,632	1,400	907	485	8
YAKIMA	20,658	5,876	4,438	1,408	30
ZILLAH	566	169	146	23	0
Totals	**179,224**	**53,433**	**42,992**	**10,216**	**198**

This initial installation resulted in 25 percent fixed network coverage of all ERT meters in the state of Washington.[1] Upon Cascade transitioning these ERT endpoints reads to a fixed network mode read, which is a stronger broadcast signal than the current ERT mobile read mode, it is expected to further expand the existing network coverage range to 30 percent of Cascade's meters in the state of Washington. This ERT read mode transition is currently underway and will continue as network equipment installation is expanded within each city or town served by Cascade.

A retrieval of fixed network meter data, after the ERT mode is switched to fixed network mode, will be conducted in November 2021 to determine if the network coverage extends far enough with existing fixed network equipment to pick up additional meter data from under-represented customer classes, such as rate schedules 505 and 511, as described in the Representative Sample Size section of this document. If it is determined that the additional meter data is not adequate to complete a near representative sample for the load study, then targeted areas will be evaluated for the addition of fixed network equipment to gather the needed data from the under-represented customer classes.

ONGOING EQUIPMENT INSTALLATION AND COVERAGE

In January 2021, Cascade began negotiations to contract with Itron to provide the fixed network design and installation of fixed network equipment on third party owned facilities to complete Cascade's fixed network. Itron began the propagation study and design of Cascade's fixed network, identifying locations needed for installation of fixed network equipment to ensure network coverage of at least 98 percent of Cascade's meters in the state of Washington. The propagation study and design were completed in July 2021. Cascade and Itron were unable to agree to contract terms for installation of the fixed network equipment, therefore Cascade is executing a contract

[1] The towns listed in Table 1 are not inclusive of all the Washington State towns served by Cascade. The towns listed are reflective of the towns where the initial Fixed Network equipment was installed. The 25 percent coverage is calculated using the assumption of 215,000 total Cascade meter count in the state of Washington, as this total count changes consistently.

directly with an experienced fixed network equipment installation contractor. This contract is expected to be in place by September 2021.

The fixed network design identified the need to install an additional estimated 330 devices throughout Cascade's service territory. Cascade is in the process of acquiring the additional devices and hardware needed to complete the installation of its fixed network. Cascade has commenced discussions and negotiations with the twelve electric utilities in Cascade's service territory for Joint Use Agreements ("JUAs"). These JUAs are required to be in place before Cascade can install equipment on third party owned poles or facilities. The average time to complete each JUA with an electric utility can range from 90 to 180 days (up to 6 months). If Cascade is unable to secure a JUA in the service area needed for fixed network equipment, or electric pole facilities are unavailable due to being underground power areas, no power areas, etc., then Cascade will evaluate the options for placing its own pole in the right of way per existing franchise agreements with cities or counties. Other options may also include entering into tower licensing agreements with other utilities or communication providers in the area.

It is planned, given the design of the fixed network and the number of electric utilities in the state of Washington that the installation of the fixed network equipment will be completed by December 30, 2022, as demonstrated in Exhibit A. As previously described in this section, once the fixed network equipment is in place, further work is required to ensure sufficient coverage and correct meter reads are being captured by the network devices. The data gathering efforts and fixed network coverage evaluations and analysis will be ongoing and can occur as equipment is installed and cities or towns reach at least 75 percent fixed network coverage.

The efforts for initial installation and ongoing installation of fixed network equipment enables the acquisition of Cascade meter data needed to complete the load study, as described in the following sections. The installation of fixed network equipment in the state of Washington is budgeted at about $8 million.

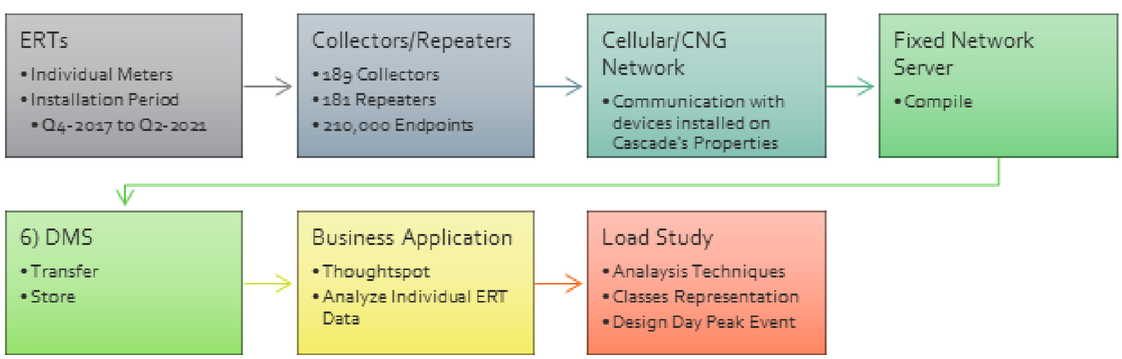
LOAD STUDY DATA AND DATA SOURCES

The data inputs for Cascade's load study include customer usage data, customer count data, and weather data. The process of collecting the data is described below:

REQUIRED COLLECTION PROCESS

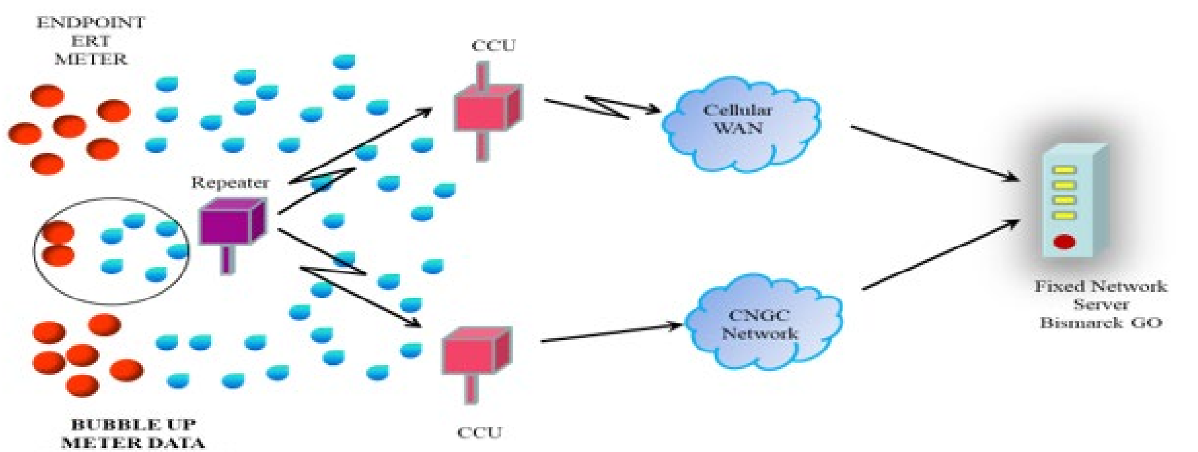
To begin collecting the data required for a load study, Cascade determined that it needed to install equipment to collect and transmit daily customer usage data. Specifically, Cascade needed to install metering equipment capable of electronically capturing and transmitting data, which are called ERTs, and develop meter reading capabilities to receive the data and transmit and store the data for subsequent use in the load study analysis. Cascade determined that it would develop a fixed network to provide the needed meter reading capabilities. A fixed network is constructed with collectors and repeaters, which are devices that relay the data from the ERTs and transmit these data over cellular and Cascade support connections back to Cascade's fixed network servers, where the individual data is compiled to a DMS, so business applications and software programs can analyze the data. Below, in Figure 1, is a flow chart to help illustrate the fixed network components and steps necessary to complete a load study.

Figure 1: Flowchart for Load Study Data Collection and Analysis



The collectors and repeaters are installed at an elevated height to maximize range, which in favorable terrain can result in readings of up to five miles from the receiver. In addition, these collectors and repeaters are installed at both Cascade's properties, such as district offices, gate stations, and rectifiers, and as pole attachments to local utility poles as part of JUAs to allow suitable coverage for the fixed network. Once installed, the fixed network can be programmed to bring daily ERT reads and allow for automated readings in areas supported by fixed network, thus allowing for Cascade to reduce its meter reading expenses and possible need to drive out to individual locations in the future. A visual diagram of the first five steps described in the flowchart (Figure 1) to collect, transmit, and store data is shown in Figure 2.

Figure 2: Visual Diagram – Stages 1-5 – Collecting and Transmitting Data



Once the individual ERT data is on the fixed network server, the data needs to be prepared, organized, and transferred into Cascade's DMS for business applications or load studies. This process is described in the following section.

DAILY WEATHER DATA

Cascade will utilize National Oceanic and Atmospheric Administration ("NOAA") to gather daily weather data information. This data is gathered at seven weather locations: four in Washington and three in Oregon. The four in Washington are: Bellingham, Bremerton, Yakima, and Walla Walla. The three in Oregon are: Baker City, Redmond, and Pendleton. Normal weather data will be provided by NOAA's 1991-2020 Climate Normals data.[2]

[2] https://www.ncdc.noaa.gov/cdo-web/datatools/normals

Cascade uses a heating degree day ("HDD") as the unit of measure of how cold the temperature was on a given day or during a period of days. An HDD compares the mean outdoor temperatures recorded for a location to a standard reference temperature. The more extreme the outside temperature, the higher the number of degree days. A high number of degree days generally results in higher levels of energy use for space heating. If the standard reference temperature less HDD is negative, then Cascade gives that day a 0 for HDD. Cascade uses 60°F as the standard reference temperature. For example, a 50°F day will result in 10 HDDs (60°F minus 50°F).

The coupling of recent cold weather events with increased utilization of natural gas for power generation has introduced unique challenges that strain the existing energy infrastructure. These challenges occur because extreme winter weather increases demand for natural gas and electric heating while also increasing the risk of failure of the energy system infrastructure during high wind, snow, and ice conditions. Cascade recorded a peak usage event due to the sheer size of the region impacted during February 9 – 15, 2021, however it was not a peak weather event that required curtailment and other demand response measures. This weather event was 37 HDDs from our standard reference temperature; however, Cascade's peak weather event was recorded on December 21, 1990, with 51 HDDs.

CUSTOMER USAGE DATA

Cascade's customer usage data for the load study is being captured daily at the "use per customer" level and temporarily stored on the fixed network. The data is then transferred to Cascade's DMS, where it is stored and provided to the load study analyst at the usage per customer, per day, by rate class and weather location level. Since the usage data is captured at that level, the rate schedule will be easily identifiable for this analysis.

CUSTOMER COUNT DATA

For each set of customer usage data, there will be one customer behind that data. The remaining number of customers will be determined by utilizing Cascade's customer count file maintained by Cascade's accounting department. If forecasted customer counts are needed, Cascade will utilize the forecasted customer counts from the Integrated Resource Plan.

Cascade will analyze customer count data to determine the representative sample for the load analysis; further sample size information is described in the next section.

REPRESENTATIVE SAMPLE SIZES

Cascade has completed the first analysis to determine the representative sample size for each class and weather location. Determining the representative sample at the weather location level ensures Cascade that there is a representation of customers across the different geographic locations. Cascade utilized confidence intervals and relative precision to determine the appropriate sample size. According to Public Utility Regulatory Policy Act ("PURPA"), it suggests that utilities should maintain a minimum 90 percent confidence interval with a 10 percent accuracy at time of class and system peaks.[3] While PURPA's recommendation is intended for electric utilities, Cascade believes these sampling parameters can be utilized for natural gas utilities as well. To determine the initial representative sample size count, Cascade pulled a week's worth of data during the coldest period during its recent winter season, which was February 9, 2021, through February 15, 2021. Table 2 provides the known population, actual customer count, and the sample count that represents the number of fixed network (fixed network reads) during the period listed above.

[3] Load Research Manual, 3rd edition, 2017, page 61: "…The desired accuracy should be determined for the study. The desired accuracy is usually expressed as a relative precision with a given confidence level. A design accuracy of +/- 10% at the 90% confidence level (often abbreviated "90/10") at the system and class peak time was specified in the Public Utility Regulatory Policy Act (PURPA) for all major rate classes (see Chapter 1 for additional background). This means that the sample will be designed to achieve a 90% confidence interval that is no more than 10% above and below the estimate of the mean. Although these federal standards were withdrawn in 1992, the PURPA specification remains load research common practice, particularly for samples that will be used to support rate cases or other regulatory requirements…".

Table 2: Known Population and Fixed Network Sample Count

			9-Feb-21	10-Feb-21	11-Feb-21	12-Feb-21	13-Feb-21	14-Feb-21
Weather Location	**Rate Class**	**Known Population (February 2021)**	Sample Count	Sample Count	Sample Count	Sample Count	Sample Count	Sample Count
Bellingham	CNGWA503	85954	12666	13063	13292	13062	12287	11564
Bellingham	CNGWA504	10390	2070	2129	2149	2093	1990	1854
Bellingham	CNGWA505	196	31	33	34	33	31	25
Bellingham	CNGWA511	26	6	6	6	6	6	6
Bremerton	CNGWA503	40730	4664	4735	4885	5029	4828	4513
Bremerton	CNGWA504	5062	1166	1166	1174	1209	1200	1157
Bremerton	CNGWA505	58	17	16	17	17	17	17
Bremerton	CNGWA511	19	4	4	4	4	3	3
Walla Walla	CNGWA503	42784	3611	3942	3815	3779	3990	3634
Walla Walla	CNGWA504	5408	1522	1574	1518	1491	1525	1435
Walla Walla	CNGWA505	54	12	12	12	12	12	11
Walla Walla	CNGWA511	17	5	5	4	3	2	1
Yakima	CNGWA503	28578	5503	5760	5684	5865	5906	5942
Yakima	CNGWA504	6221	2155	2200	2174	2210	2210	2200
Yakima	CNGWA505	177	43	43	43	43	40	45
Yakima	CNGWA511	31	8	8	8	8	7	8

With the information gathered, Cascade utilized the average, standard deviation, and variance of the actual data along with the z-score[4] for the 90 percent confidence intervals and the 10 percent precision of accuracy. Cascade can calculate a simple random sample-mean-per-unit estimation, which is a representative sample count estimate based on known average, variance, confidence interval, and precision of accuracy.

Formula:

$$n^0 = \frac{Z^2 * s_y^2}{D^2 * \bar{y}^2}$$

Formula Notes:

- $n^0 = simple\ \mathrm{random}\ sample - mean - per - unit\ estimation$
- $Z = z - score\ based\ on\ 90\ percent\ confidence\ interval$
- $s = variance\ of\ y$
- $D = desired\ relative\ precision$
- $\bar{y} = avereage\ use\ per\ customer\ by\ rate\ schedule\ and\ weather\ location$

[4] A z-score is a numerical measurement that describes a value's relationship to the mean of a group of values. A z-score is measured in terms of standard deviations from the mean. If a z-score is 0, it indicates that the data point's score is identical to the mean score. A z-score of 1.0 would indicate a value that is one standard deviation from the mean. A z-scores may be positive or negative, with a positive value indicating the score is above the mean and a negative score indicating it is below the mean.

Table 3 shows the average, standard deviation, variance, and the simple random sample-mean-per-unit estimation for each weather location and rate schedule for February 9, 2021.

Table 3: Simple Random Sample-Mean-Per-Unit Estimation

		9-Feb-21			
Weather Location	**Rate Class**	Average of Sample	Std Dev of Sample	Variance of Sample	Simple Random Sample-Mean-Per-Unit Estimation
Bellingham	CNGWA503	4.091887467	2.298500747	5.283105682	85
Bellingham	CNGWA504	15.91251765	30.39203721	923.6759258	987
Bellingham	CNGWA505	84.2498571	114.1713456	13035.09616	196
Bellingham	CNGWA511	257.6603383	160.3683081	25717.99423	26
Bremerton	CNGWA503	3.607587832	2.289821685	5.243283349	109
Bremerton	CNGWA504	19.42605161	37.11893037	1377.814992	988
Bremerton	CNGWA505	52.24799059	48.30301843	2333.18159	58
Bremerton	CNGWA511	205.1663875	87.99347814	7742.852195	19
Walla Walla	CNGWA503	3.831241626	2.335362947	5.453920093	101
Walla Walla	CNGWA504	20.81029619	40.51222152	1641.240092	1026
Walla Walla	CNGWA505	74.1282725	111.2028688	12366.07802	54
Walla Walla	CNGWA511	398.0032	242.3198873	58718.92776	17
Yakima	CNGWA503	3.726891392	3.174017324	10.07438597	196
Yakima	CNGWA504	21.60580361	40.65904151	1653.157657	958
Yakima	CNGWA505	110.8799049	114.4932253	13108.69865	177
Yakima	CNGWA511	369.5092738	179.1723757	32102.74021	31

Comparing the simple random sample-mean-per-unit estimation to the actual sample count allows Cascade to determine if there is a representative sample for that rate schedule and weather location. If the actual count is greater than the simple random sample-mean-per-unit estimation, then it is determined there is a representative sample. Cascade calculated the average sample count from the February 9-15 data and compared it to the average simple random sample-mean-per-unit estimation for each rate schedule and weather location. Table 4 shows those results.

Table 4: Representative Sample Size Results

Weather Location	Rate Class	Known Population (February 2021)	Average Sample Count	Average Simple Random Sample-Mean-Per-Unit Estimation	Do we have a representative sample?
Bellingham	CNGWA503	85954	12490	87	Yes
Bellingham	CNGWA504	10390	2021	1003	Yes
Bellingham	CNGWA505	196	30	196	No
Bellingham	CNGWA511	26	6	26	No
Bremerton	CNGWA503	40730	4726	117	Yes
Bremerton	CNGWA504	5062	1172	837	Yes
Bremerton	CNGWA505	58	17	58	No
Bremerton	CNGWA511	19	4	19	No
Walla Walla	CNGWA503	42784	3720	107	Yes
Walla Walla	CNGWA504	5408	1496	832	Yes
Walla Walla	CNGWA505	54	12	54	No
Walla Walla	CNGWA511	17	3	12	No
Yakima	CNGWA503	28578	5783	178	Yes
Yakima	CNGWA504	6221	2188	879	Yes
Yakima	CNGWA505	177	43	177	No
Yakima	CNGWA511	31	8	30	No

As seen in Table 4, the results show that rate schedules 503 and 504 currently have a representative sample size to complete a load study. The results also show that rate schedules 505 and 511 do not have a representative sample. Although rate schedules 505 and 511 do not have a representative sample, a load study can still be complete with the caveat that the results may not fall within the 90 percent confidence intervals and the 10 percent precision of accuracy. The steps to reach the desired level of representative sample size was discussed in the previous section. Cascade will pull fixed network data at the beginning of November, as a check to fixed network sample counts prior to the 2021-2022 winter season.

LOAD STUDY ANALYSIS TECHNIQUES

Cascade has several techniques to choose from when analyzing a sample set of data for its load study. Each technique provides a different analysis with the same end goal result to determine the design day allocator based on peak data to be used within Cascade's cost of service study. However, each analysis technique would provide varying results so deciding which analysis technique to use will be important. Cascade will begin these analysis techniques in March 2022. The three analysis techniques that Cascade plans to evaluate are: a regression analysis, a mean-per-unit analysis, and a ratio analysis which each are described below.

REGRESSION ANALYSIS

Regression analysis is a set of statistical method used to describe a relationship between explanatory variables and response variables.

Model:

$$\frac{Therms}{C_{Class}} = \alpha_0 + \alpha_1 HDD^D + \alpha_2 L_w + \alpha_3 WIND^D + Fourier_{(k)} + ARIMA_{(p,d,q)}$$

Model Notes:

- $\frac{Therms}{C_{Class}} = Usage\ by\ customer\ class.$
- $HDD^D = Daily\ Heating\ Degree\ Days\ from\ Weather\ Location.$
- $w = Weekend\ Indicator$
- $WIND^D = Daily\ Wind\ Speed\ Average\ from\ Weather\ Location.$
- $ARIMA(p,d,q) = Indicates\ that\ the\ model\ has\ p\ autoregressive\ terms, d\ difference\ terms, and\ q\ moving\ average\ terms.$
- $Fourier(k) = Indicates\ k\ number\ of\ seasonalities\ within\ dataset.$

Cascade begins by running a simple linear model regressing on HDD's and wind by month, then the residuals are analyzed using the Durbin-Watson statistic test[5] to check for autocorrelation. If found, the model then adds an autoregressive integrated moving average ("ARIMA") term[6] and a Fourier analysis term[7]. To run Fourier terms alongside ARIMA terms, the ARIMA term must be forced to not difference the data. Cascade pursues this process for each rate schedule and weather zone. As with the

[5] The Durbin-Watson statistic will always have a value ranging between 0 and 4. A value of 2.0 indicates there is no autocorrelation detected in the sample. Values from 0 to less than 2 points to positive autocorrelation and values from 2 to 4 means negative autocorrelation. Autocorrelation can be useful in technical analysis to measure the relationship between a variable's current value and its past values.
[6] A statistical analysis that uses time series data to either better understand the data set or to predict future trends.
[7] An analysis of the way general functions may be represented or approximated by sums of simpler trigonometric functions.

customer forecast, Cascade uses Akaike information criterion, among other statistics, in determining which model to use. Below are the advantages and disadvantages of this technique.

Advantages: This technique gives the best estimation of usage while utilizing explanatory variables.

Disadvantages: Is more complex and time consuming than other analysis techniques or methodologies, requiring advanced analytical understanding of regression concepts. This technique also requires utilization of a statistical software packages. Cascade uses the R programming language widely used among statisticians and data miners for developing statistical software and data analysis.

MEAN-PER-UNIT ANALYSIS

The mean-per-unit analysis calculates an estimated demand per customer and expands this estimate to the target population by multiplying by the number of customers in the population.

Model:

$$\bar{y} = \sum_{i=1}^{n} \frac{y_i}{n}$$

Model Notes:

- $\bar{y} = Sample\ mean\ of\ y\ variable.$
- $y_i = usage\ for\ sample\ i$
- $n = number\ in\ sample\ size$

Once this analysis is complete, Cascade would apply $\bar{y}$ to the entire population, customers inside and outside of the sample size, to calculate the total usage for the customer class. Below are the advantages and disadvantages of this technique.

Advantages: This technique is efficiency, easy to use and apply compared to other methods, and generality easily understood.

Disadvantages: Does not account for the fact that usage will vary with weather; for example, this methodology could be useful if the sample size is limited to data within a narrow range of HDDs. This technique would require an exceptionally large sample size, so the model can break the data down into different ranges of HDDs, thus usage data could be grouped together for similar weather events, such as 45-50 HDDs. This would require a few days of 45-50 HDDs to be recorded for Cascade to analyze usage with similar weather events.

RATIO ANALYSIS

Ratio analysis is a technique that can take advantage of the correlation of the y and x variables to obtain increased precision.

Model:

$$r = \frac{\sum_{i=1}^{n} y_i}{\sum_{i=1}^{n} x_i}$$

Model Notes:

- $r = ratio\ of\ y\ and\ x$
- $y_i = usage\ for\ sample\ i$
- $x_i = HDD\ for\ sample\ i$

Once this analysis is complete, Cascade would apply r to the entire population, customers inside and outside of the sample size, to calculate the total usage by HDD for each customer class. Below are the advantages and disadvantages of this technique.

Advantages: This technique, like that of mean-per-unit analysis is efficient, easy to use and apply compared to other methods, and easily understood. This technique can be used when x and y variables are highly linearly correlated.

Disadvantages: Does not capture trends or estimates as well as a regression analysis. In addition, only one explanatory variable can be used for the denominator in this technique.

CONCLUSION

As presented above, Cascade has made significant progress in addressing the Commission's requirement for a load study. As required, the load study will be completed and filed with the Commission by September 21, 2022. The study will provide the results of utilizing the fixed network data collected for analysis techniques to compute the load each class is responsible for during a peak winter event, as well as the annual total.

There are risks that the load study will not satisfy all the requirements of WAC rules. The main risks are not having an accurate load study per the definition of WAC 480-85-030(5) due to insufficient representative customer class sample sizes to meet a 90 percent confidence level, a minimum twelve-months of reliable data, and the lack of a peak winter event being realized to be useful. Cascade is committed to doing everything within its control to present a load study to fulfill the WAC requirements but circumstances beyond our control, such as, weather, outside contractors, site permits, and JUA's may influence the final product.

Cascade will continue to work diligently to put in place the required infrastructure to collect the necessary data and has allocated the personnel to analyze and report on this data. Cascade will share significant progress, delays, or other issues with the Commission to keep you fully informed as we progress through the timeline.