BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

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

PREFILED DIRECT TESTIMONY (NONCONFIDENTIAL) OF

DR. CHHANDITA DAS

ON BEHALF OF PUGET SOUND ENERGY

FEBRUARY 15, 2024

PUGET SOUND ENERGY

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DR. CHHANDITA DAS

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I. INTRODUCTION

Q. **Please state your name, business address, and position with Puget Sound Energy.**

A. My name is Dr. Chhandita Das and my business address is Puget Sound Energy, P.O. Box 97034, Bellevue, Washington 98009-9734. I am employed by Puget Sound Energy ("PSE") as Senior Economic Analyst in the Pricing and Cost of Service Team since March 2019.

Q. **Have you prepared an exhibit describing your education, relevant employment experience, and other professional qualifications?**

A. Yes. Exh. CD-2 describes my education, relevant employment experience, and other professional qualifications.

Q. **What are your duties as Senior Economic Analyst for PSE?**

A. As the Senior Economic Analyst for the Pricing and Cost of Service team, I primarily support the load research effort within the group, which includes conducting load research studies for general rate case ("GRC") fillings. I also work towards improving the load research methodology and process by using new tools, new sources of data (such as Advanced Metering Infrastructure), and

1 increasing efficiency through automation. I also explore new data products using

2 load profiles, like the net meter customer behavior study.

3 **Q.** **What topics are you covering in your testimony?**

4 A. My testimony presents the results of PSE's 2024 general rate case Class Load

5 Research used to perform its electric cost of service study and rate design. PSE's

6 2024 Load Research Report is provided as Exh. CD-3.

II. ELECTRIC LOAD RESEARCH

A. <u>**Electric Load Research**</u>

9 **Q.** **How does PSE perform its electric load research?**

10 A. PSE performs its electric load research to support its electric cost of service study

11 and rate design for a test year period. The method includes (i) developing hourly

12 load profiles for each rate class, (ii) calculating monthly load estimates (total and

13 average), and (iii) calculating peak demand estimates (non-coincident and

14 coincident). Hourly data, which were aggregated from 15-minutes interval load

15 data, were used for class load profiles for residential, large and medium-size rate

16 classes, and for some small rate classes and transportation customers. The load

17 research analysis includes processing the interval data, validating data quality,

18 adjusting for gaps when the full population data are not available or cannot be

19 used, developing load profiles, and calculating summary statistics.

1   Q.   **Did PSE use the same load research methodology in this case as in its last**

2   **general rate case?**

3   A.   The core methodology used to develop load profiles remains the same. However,

4   the process used in this rate case differs from the one used in the last rate case.

5   The major difference is the use of population data for developing load profiles

6   instead of using data from a sample of approximately 1,500 meters.

7   WAC 480-85-050 (cost of service study inputs) requires that usage data for a

8   cost-of-service study must come from the best available source, such as advanced

9   metering infrastructure ("AMI") or automated meter reading ("AMR"). PSE

10   started mass implementation of AMI meters in mid-March 2018, and the study

11   includes data from July 2022 through June 2023, while AMI deployment was

12   underway. In this rate case, PSE attempted to develop class load profiles using the

13   full spectrum of interval data that is currently available and usable. At the time of

14   this study, the number of meters that had a full year's worth of hourly interval

15   data (and hence were eligible to be included in the analyses) yielded a coverage

16   rate range of 32% (irrigation) to 99% (residential) across different rates. The

17   coverage rate measures the percentage of a customer class that has AMI meters

18   providing PSE with data it can use in its load research.

19   Q.   **Did a consultant help PSE prepare its electric load research?**

20   A.   Yes. PSE is not currently capable of processing hourly interval data from nearly

21   one million customers and applying multiple data validation mythologies to clean

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1 and validate the data. PSE engaged DNV Energy Insights ("DNV") to assist with

2 the analyses because of its expertise in the field of load research and its ability to

3 process a large volume of interval data.

4 DNV is a respected consulting company specializing in load research analysis

5 with over 40 years of experience. DNV supported PSE's gas load research in the

6 2022 rate case. PSE leveraged DNV's expertise in processing a large volume of

7 AMI data and developing load profiles in this rate case. The class load profiles

8 produced by DNV were then supplemented with the analyses done in-house

9 which consisted of processing multiple sources of supplemental data and

10 producing summary statistics.

11 **Q.**   **What methodology did DNV use in this analysis?**

12 DNV used standard load research practices in its review and analysis of the

13 electric load data. At the time of the analysis, hourly data were not available for

14 all its electric customers for the entire test period. This analysis takes advantage of

15 as much data as possible and in cases when full population data are not available,

16 it uses standard statistical techniques (like stratified ratio estimation) to expand

17 the available daily data to the full populations of interest. Under stratified ratio

18 estimation, PSE leverages data available for the various rate class samples (i.e.,

19 the hourly electric usage data) with information known for the full population of

20 customers (such as the annual billed energy). In our analysis, the population of

21 customers were stratified based on rate class and annual use. Next, the available

22 sample data are mapped back into the populations of interest. This allows us to

1   create "case weights" that are used to weight the available sample data to the

2   populations of interest. A case weight is simply the number of customers in the

3   population of interest represented by each available sample point. Exh. CD-3

4   explains in detail the data coverage by rate.

5 **Q.**   **Please describe the statistical methodologies and the historical interval load**

6   **data, energy sales, and customer data used for PSE's Load Research Report.**

7 A.   PSE's Load Research Report, Exh. CD-3, contains detailed descriptions of the

8   statistical methodologies and validation tests performed and the historical data

9   analyzed.

10   Table 1 shows the rate classes studied, the total number of accounts, total annual

11   sales in kWh, and the average annual kWh sales per account for each rate class.

12   The Residential class (Schedule 7) contains 1,071,481 accounts (88% of all

13   accounts) with a total annual energy use of 11,732 GWh (54.2% of the total

14   system energy use).

Table 1: Population Count and Consumption Data

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%**

Q. Please summarize the results of PSE's load research results.

A. PSE's load research results are summarized and illustrated in charts and summary tables in Exh. CD-3. For the test year ending June 30, 2023, the load research results include class hourly load shapes for the year, class hourly loads during the system peak week, monthly non-coincident peak demand by class and monthly coincident demand by class (class contributions to system peak), monthly load factors, and coincidence factors by class. In addition, statistical summary tables in the report also show class monthly non-coincident peak and system coincident peak demand values averaged for twelve months and for the mid-winter months.

1   **Figure 1: Composition of System Load during Annual System Peak Week**

System Peak week 12/18/2022 - 12/24/2022

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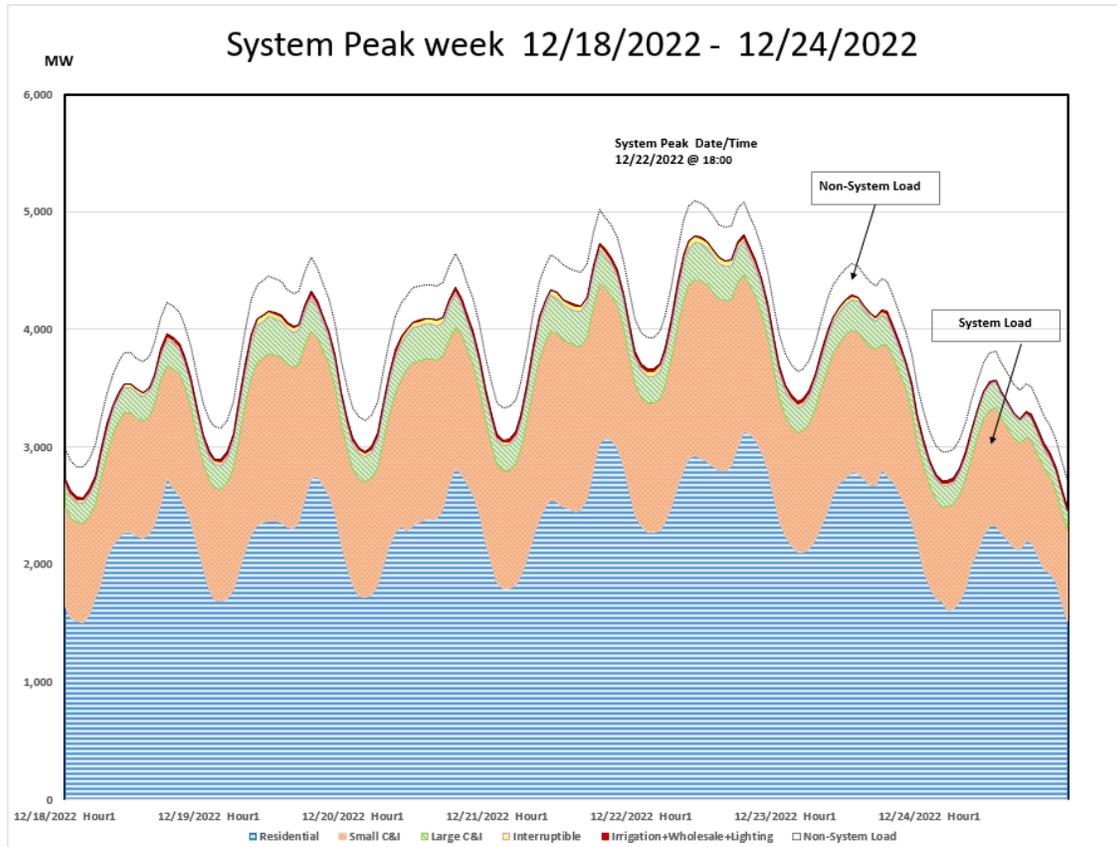
3   Figure 1 shows how the total PSE system loads are composed of the class loads

4   during the annual system peak demand week. During the test year, PSE system

5   peak occurred on December 22, 2022, at 6 PM with a total load at 4,807 MW. As

6   shown in the graph, the Residential class contributes to the largest share of the

7   system peak demand and the Small C&I class is the second largest contributor to

8   the system peak. Figure 1 also superimposes non-system loads on top of the

9   system loads to illustrate the total loads transmitted by PSE during its system peak

10   week.

Table 2: Coincident Peak Load and Factor by Rate Class

Rate Class	Peak Demand (kW)	Coincidence Factor
System Peak	4,807,263	-
System Rate Classes		
7	3,130,090	97.5%
8 & 24	551,140	84.9%
11 & 25	526,314	78.8%
12 & 26	283,530	79.8%
29	276	4.8%
10 & 31	189,810	80.5%
43	31,409	55.0%
5	2,598	78.7%
35	1	0.2%
46	8,780	44.7%
49	66,068	82.0%
50 - 59	17,246	41.8%
Non System Rate Classes		
449HV	186,392	93.4%
449PV	2,021	84.7%
459	35,681	67.5%
Special Contract	55,697	90.8%

Table 2 shows the class coincident peak loads and the coincidence factors by rate class. The data shows residential being the largest rate schedule, accounts for 65% of the peak system load with a coincident peak load of 3,130 MW. The small and medium general service classes, each of them accounts for about 11% of the system peak load. In addition, residential class has the highest coincidence factor of 97.5% and schedule 29 and 35 have the lowest (<5%). Because of the seasonality of schedules 29 and 35, these low co-incident factors are justified. For details on class peaks by months, load factors and other detail summary results please see Exh. CD-3.

1 **B.   Net Meter Load Profile**

2 **Q.   How did you develop the net meter load profiles?**

3 A.   The net meter load profiles are developed using the same methodology as

4   described above along with the other non-net meter load profiles. The net meter

5   load profiles were estimated for the residential (schedule 7), small general service

6   (schedules 8 & 24), and medium general service (schedules 11 & 25) commercial

7   rate classes as these were the only classes with sufficient interval data for

8   sufficient sample. Table 3 shows the population and sample size for the all the

9   rate classes with net meters during the test year.

10   **Table 3: Population and Sample Count by Rate Class for Net Meter Customers**

Rate Class	Population (Device Location Count)	Sample (Device Location Count)
8 & 24 (C & I)	923	798
7	18,639	17,710
11 & 25 C	164	52
25 (I)	2	-
26 C	20	-
31 (C & I)	22	-
43	6	-
29	1	-
Total	19,777	18,560

11

12   In order to estimate separate net meter profiles for customers classes 7, 8 & 24,

13   and 11 & 25 (C-commercial), different meter types were treated separately. At the

14   final stage of the analysis, the net meter and non-net meter customer load profiles

15   were added up to produce class level load profiles before calculating class

1   summary statistics. The details of the method and treatment of these customers

2   and the final result summaries are explained in Exh. CD-4.

3 **Q.**   **Please summarize the net meter load profile study results.**

4 A.   A brief summary of the findings from the net meter load profile study is presented

5   here, with greater detail provided in Exh. CD-4.

Table 4: Population Count and Consumption Data for Net Meter Classes

Rate Class	No. of Accounts	Total Annual kWh Use	Avg. kWh use per account	% of Total kWh Sales
7 - NM	17,710	92,135,650	5,202	0.53%
7 - Non NM	1,072,410	11,639,620,199	10,854	66.84%
8 & 24 (C & I) - NM	798	16,630,323	20,840	0.10%
8 & 24 (C & I) - Non-NM	125,899	2,779,857,684	22,080	15.96%
11 & 25 (C) - NM	52	8,910,197	171,350	0.05%
11 & 25 (C) - Non-NM	7,846	2,878,044,378	366,817	16.53%
Total	1,224,715	17,415,198,431	14,220	100%

Note: For net meters, the net kWh is reported in the table.

8   Table 4 shows the breakdown of annual sales by customer types for schedules 7, 8

9   & 24, and 11 & 25 (commercial). For each rate class studied here, the net meter

10   customers account for less than 1% of total class sales. For details on hourly load

11   profiles for net meter and non-net meter customers, monthly coincidence peak,

12   coincidence factors, class peaks and load factors, please see Exh. CD-4.

Table 5: Net Meter Customers' Coincident Peak and Coincident Factor

Rate Class	Coincident Peak Demand (kW)	Coincidence Factor	Class Peak Demand (kW)
System Peak	4,807,000	-	
Net Meter Rate Schedules			
7 - Non-net meter	3,069,916	100.0%	3,069,916
7 - Net meter	60,174	100.0%	60,174
8 & 24 Non-net meter	544,413	89.3%	609,907
8 & 24 Net meter	6,727	93.6%	7,185
11 & 25 (C)- Non-net meter	505,166	88.4%	571,635
11 & 25 (C)- Net meter	2,179	95%	2,292

Table 5 shows the net meter and non-net meter customers' coincident peaks and coincident factors. Since a majority of class 7 customers are non-net meter, their coincident peaks and coincidence factor are the same as the full class coincidence factor. The net meter residential customers' coincidence peak was 60.1 MW, about 1% of the system peak load. The net meter class peak was on the same day as the total class and the system peak date and time. Further, it was observed that peak demand per net meter customer was 3.90 kW, higher than 2.98 kW for non-net meter customer. In addition, the minimum load, or the maximum return to the grid for residential net meter customers, occurred on June 5, 2023, at 2 PM with – 99.3 MW of net load (returned load 101.4 MW).

The 8 & 24 class's non net meter coincidence peak and coincidence factor are similar to the full class coincidence peak. The net meter coincidence peak was 6,727 kW, which is only 0.1% of the system peak load. The class peak for 8 & 24 class net meter customer was 7.2 MW on December 22, 2022, at 9 AM. Comparing peak demand per customer, net meter customers again had a higher

average peak demand (8.83 kW) than non-net meters customers (4.74 kW). The

minimum load for schedule 8 & 24 (commercial) net meter customers was on

June 4, 2023, at 2 PM with –7.1 MW load (returned load 8 MW).

Table 5 also shows the schedule 11 & 25 (C) class's non-net meter coincidence

peak and coincidence factor are similar to the full class coincidence peak. The net

meter coincidence peak was 2,179 kW which is only 0.05% of the system peak

load. The class peak for schedule 11 & 25 (C) class net meter customers was

2,292 kW on December 22, 2022, at 5 PM. Comparing peak demand per

customer, net meter customers average peak demand (54.72 kW) was lower than

non-net meters customers (74.70 kW). The minimum load for schedule 11 & 25

(C) net meter customers was on June 3, 2023, at 1 PM with –113 kW load

(returned load 546 kW).

C.   Clean Energy Transformation Act ("CETA") and Customer Load Profiles

Q.   **How does PSE foresee the load research to evolve to align with CETA?**

A.   PSE recognizes that in order to achieve an equitable distribution of the costs and

benefits associated with CETA, there is a need to rethink the load research and

how it can best inform the cost of service rate makings. Load profiles for different

customer groups (by income, energy burden and vulnerability index) would

reflect better information regarding customer usage, which could help the cost-of-

service studies for a fair and equitable rate making. PSE intends to explore the

| 1 | | feasibility of this effort, which would require identifying interested groups and |

1　　feasibility of this effort, which would require identifying interested groups and

2　　investigating data coverage and data quality for these groups.

III. CONCLUSION

4　**Q.**　**What do you recommend based on the 2024 load research performed by**

5　　**PSE?**

6　A.　The load research results presented in Exh. CD-3 and Exh. CD-4 are based on a

7　　thorough analysis of the hourly load data by class, system hourly load data,

8　　monthly and annual class sales, and customer data. For this rate case, PSE

9　　conducted load research based on all customers who had hourly load data

10　　available instead of 1,500 customers' interval load data. Allowing a large sample

11　　size could potentially improve the load profiles estimates and reduce sampling

12　　errors. They were statistically validated for accuracy and reasonableness. The

13　　distinction of net meter and non-net meter customers further improves the results.

14　　PSE is continuously striving to improve data and methodologies. The current load

15　　research analysis was conducted using the best available data sources and

16　　technology at hand, and I recommend that the Commission approve the load

17　　research results provided in Exh. CD-3 as a basis for PSE's electric cost of service

18　　study and rate design in this proceeding.

19　**Q.**　**Does that conclude your prefiled direct testimony?**

20　A.　Yes, it does.