EXHIBIT NO. ___(CKC-1T)
DOCKETS UE-17___/UG-17___
2017 PSE GENERAL RATE CASE
WITNESS: DR. CHUN K. CHANG

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY,** **Respondent.**	**Docket UE-17____** **Docket UG-17____**

PREFILED DIRECT TESTIMONY (NONCONFIDENTIAL) OF

DR. CHUN K. CHANG

ON BEHALF OF PUGET SOUND ENERGY

JANUARY 13, 2017

PUGET SOUND ENERGY

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PUGET SOUND ENERGY

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I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Chun K. Chang, and my business address is 10885 N.E. Fourth Street, Bellevue, Washington 98004. I am employed by Puget Sound Energy ("PSE") as a Regulatory Consultant in Pricing and Cost of Service.

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

A. Yes. It is the First Exhibit to my Prefiled Direct Testimony, Exhibit No. ___(CKC-2).

Q. Please summarize the purpose of your testimony.

A. The purpose of my testimony is to present PSE's electric and gas temperature adjustment methodologies and results used to develop the pro forma electric and gas sales for the test year in this proceeding, October 2015 through September 2016.

II. ELECTRIC AND GAS SALES WEATHER NORMALIZATION

Q. Generally speaking, what is sales weather normalization and how does PSE perform its sales weather normalization?

A. The sales weather normalization is performed to adjust the test year sales volume so that the adjusted sales represent what the test year sales volume would have been if the weather had been normal. Weather normalization modifies the test year billing determinants and revenue requirements to be more representative of the average weather conditions expected when the rates proposed in this case go into effect.

PSE first analyzes the relationship between actual loads and temperatures for the most recent four-year period (2012 through 2015) and develops econometric models to measure temperature sensitivity of electric and gas energy use. Multivariate regression analysis is used to isolate the weather effects from other factors such as type of day (*e.g.*, weekdays, weekends or holidays) and seasonal effects not related to temperature. The estimated model coefficients of temperature variables are called "weather sensitivity coefficients."

Then, PSE uses the weather sensitivity coefficients and "normal" weather data to convert the actual test year sales to "normal weather" sales. PSE calculates the "normal" weather values from the actual historical temperature data compiled for the most recent thirty years.

Q. Did PSE use the same weather normalization methodology in this case as in its last general rate case?

A. Yes. The methodology used in this case is the same temperature adjustment methodology PSE used in its 2011 general rate case ("2011 GRC"), except that the modeling input data period was updated from the four-year period of 2007–2010 to the period of 2012-2015 and the daily electric energy usage history by customer and rate schedule was collected from the samples refreshed in April 2015. The temperature adjustments of electric sales and gas sales performed by PSE were not contested in 2011 GRC.[1]

A. <u>Normal Versus Actual Test Year Weather</u>

Q. Please describe the actual weather experienced during this proceeding's test year.

A. Based on monthly history of heating degree days, Table 1 compares the actual monthly weather in the test year and the previous nine years with the normal weather defined by the average values calculated for the most recent thirty years of 1986-2015. The hourly temperatures recorded at Seattle-Tacoma International Airport ("Sea-Tac") were used to calculate daily average temperatures. The daily average temperatures were then converted to heating degree days ("HDDs") with

[1] See Docket No. UE-111048 and UG-111049 (consolidated), Order 08, ¶¶ 196-200 (May 7, 2012).

a base temperature of 65˚F.[2] Monthly total HDDs were obtained by summing the daily HDD for the month. For the test year, the overall weather, as measured by the sum of monthly total HDDs in October 2015 through September 2016, was significantly milder than normal. The only exception was November 2015 when it was 8.3 percent colder normal. Total number of test year HDDs was 4,084 and was 15.5 percent smaller than the annual sum of normal HDDs, 4,831.

Table 1

Monthly History of HDD65, Jan. 2006 - Sept. 2016

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	30-Year Normal*	% Diff from Normal (10/ 2015-9/ 2016)
Jan	581	833	820	813	562	716	778	828	666	629	664	719	-7.6%
Feb	624	610	630	660	515	726	629	581	657	457	516	636	-21.7%
Mar	623	567	694	725	564	624	684	539	536	456	510	589	-13.4%
Apr	461	464	568	486	486	596	436	444	405	428	290	456	-36.5%
May	281	302	306	294	388	406	317	235	213	213	189	302	-37.4%
Jun	126	176	252	95	224	199	220	77	126	44	123	162	-24.1%
Jul	54	19	71	41	113	80	68	23	21	8	34	63	-46.2%
Aug	60	49	77	59	95	44	31	8	13	18	32	49	-33.9%
Sep	133	193	144	122	155	96	110	114	63	165	137	141	-2.3%
Oct	415	462	422	404	377	412	360	432	239	260		384	-32.4%
Nov	623	625	482	556	652	659	550	519	583	636		587	8.3%
Dec	761	778	866	841	683	788	733	774	624	694		744	-6.7%
Total	4,743	5,079	5,332	5,095	4,816	5,346	4,916	4,573	4,145	4,007		4,831	
% Diff. from Normal	-1.8%	5.1%	9.8%	5.5%	-0.3%	10.7%	1.3%	-5.3%	-14.2%	-17.1%			

*February normal is based on 28 days for non-leap year. Percent differences from normal for 2008, 2012 and 2016 are based on a 29-day normal February with 659 HDDs. Normal weather values are 30-year average values for 1986-2015.

The deviation from normal weather was more substantial for some months. As shown in the last column of Table 1, the winter weather in February and April 2016 and October 2015 was 21.7 percent, 36.5 percent and 32.4 percent warmer than normal, respectively.

[2] A heating degree day (HDD) is the negative deviation in average daily temperature from the base temperature. For a base temperature of 65˚F, heating degree days equal 65 minus the average daily temperature (if the average temperature is less than 65). If the average daily temperature is greater than 65, HDD is 0. Thus, one day that averages 35˚F would have 30 HDDs (using a base of 65˚F). Similarly, 30 days with an average temperature of 64˚F each day would also have 30 HDDs.

B. Temperature Adjustment of Electric Sales

Q. Please describe how the electric sales temperature adjustment was calculated.

A. The system-level temperature adjustment was calculated by month and allocated to each of the applicable rate schedules, based on a temperature adjustment methodology identical to the one used in PSE's 2011 GRC, with the hourly temperature and daily energy use data updated for Jan. 1, 2012 through Dec. 31, 2015.

Q. Please describe how the system-level test year load was normalized for weather.

A. PSE used weather sensitivity coefficients based on actual daily load data and actual temperature data at Sea-Tac to adjust system-level delivered load (Generated, Purchased and Interchanged load, or "GPI") for weather. The weather sensitivity coefficients were estimated by developing an econometric model with a four-year (2012-2015) history of daily GPI, HDDs and cooling degree days ("CDDs").[3] The temperature variable coefficients vary by month. This is the same methodology PSE used in its last two general rate cases.

PSE's "normal" weather dataset was developed using the hourly temperature data recorded at Sea-Tac over the 30-year period from 1986 through 2015 by

[3] A Cooling Degree Day is calculated in the same way as a Heating Degree Day is calculated, except that it counts number of degrees above the base temperature.

calculating daily HDDs and CDDs using several base temperatures (45˚F and 65˚F for HDDs; 60˚F and 65˚F for CDDs). PSE then calculated the amount of temperature adjustment by taking the temperature variable coefficients from the econometric model and multiplying them by the difference between the actual and normal HDDs and CDDs. This process was performed on a monthly basis and aggregated for all of the HDD and CDD variables included in the model.

Q. How did you allocate the temperature adjustment among electric rate schedules?

A. PSE used a three-step process to allocate the system-level temperature adjustment to rate schedules (classes) in order to produce rate schedule pro forma temperature-adjusted billing determinants. The first step was to develop econometric model equations to characterize the relationship between the temperature variables and the daily energy use per customer by class. The temperature variable coefficients of those equations vary by rate class. The data source for this step was a large sample of daily energy readings by rate schedule from PSE's automated meter reading database. The historical data period set for modeling is the same four-year period of 2012 through 2015 as used for the system weather sensitivity modeling.

The second step was to calculate the temperature adjustment to monthly energy use per customer for each rate schedule by taking the temperature variable coefficients from the class model equation and multiplying them by the difference between the actual and normal HDDs and CDDs for the month.

The third step was to estimate monthly adjustment to class total sales by multiplying the monthly adjustment per customer calculated in the previous step by the actual number of customers by month and rate schedule. The amount of monthly adjustment at the GPI level was allocated to each of the applicable schedules by calculating the percentage share of each schedule's adjustment amount relative to the sum of temperature adjustment for all classes as estimated through the rate class normalization process, and by multiplying the system total temperature adjustment by this percentage share.

Q. Please summarize the final results of electric sales weather normalization.

A. As shown in Table 2, below, applying the process described above to the test year GPI load of 22,007,938 megawatt hours ("MWhs") resulted in a total adjustment of 303,891 MWh, or 281,707 MWh delivered load when adjusted for losses. Because the test year winter was warmer than normal, this adjustment resulted in a pro forma delivered system load that is larger than actual load delivered during the test year.

Table 2

Temperature Adjustment of Test Year Electric GPI

Month	Actual GPI (MWH)	Temp. Adj. GPI (MWH)	Adj. (MWH)	Adj. (MWH) net of Losses
(1)	(2)	(3)	(4)=(3)-(2)	(5)=(4)*(1-0.069)
Oct-15	1,709,553	1,757,266	47,713	44,230
Nov-15	2,071,075	2,021,560	(49,515)	(45,900)
Dec-15	2,293,718	2,341,463	47,745	44,260
Jan-16	2,264,400	2,313,152	48,751	45,193
Feb-16	1,926,705	2,027,518	100,813	93,454
Mar-16	1,958,546	2,015,037	56,491	52,367
Apr-16	1,641,033	1,717,808	76,776	71,171
May-16	1,626,433	1,641,731	15,298	14,181
Jun-16	1,597,201	1,584,799	(12,401)	(11,496)
Jul-16	1,647,778	1,645,397	(2,381)	(2,207)
Aug-16	1,712,298	1,680,389	(31,909)	(29,580)
Sep-16	1,559,199	1,565,709	6,510	6,035
Total	22,007,938	22,311,829	303,891	281,707

When the GPI temperature adjustment was allocated to the rate schedules, residential sales increased by 242,970 MWh and the loads of all but Schedules 12 & 26 (Large Demand General Service) and Schedule 29 (Irrigation) also increased. The irrigation load is sensitive only to the summer weather. Sum of monthly CDDs calculated with the base temperature of 60˚F in May through September 2016 was 635 and it was 23.5 percent higher than the thirty-year normal value of 514. Consequently, the actual irrigation sales were lowered by 1.2 percent when the sales were temperature normalized for the warmer-than-normal summer weather. Summer air-conditioning and refrigeration loads of the Large Demand General Service class take more of its annual electric energy use than winter space-heating load. Therefore, temperature normalization lowered the test-year actual sales slightly by 0.1 percent, in spite of the warmer-than-normal winter weather prevailed in the test year. Table 3 presents the temperature adjustment of electric sales by rate schedule.

Table 3

Temperature Adjustment of Test Year Electric Sales by Rate Schedule (MWH)

	Residential (Sch. 7, 17, 27, 37 & 47)			General Service (GS) (Sch. 8 & 24)			Small Demand GS (Sch. 7A, 11 & 25)		
Month	Actual	Normalized	Adj.	Actual	Normalized	Adj.	Actual	Normalized	Adj.
Oct-15	684,452	723,655	39,203	206,618	209,778	3,160	225,479	226,672	1,193
Nov-15	834,616	798,085	(36,531)	217,896	213,365	(4,531)	228,434	225,529	(2,905)
Dec-15	1,150,604	1,185,744	35,141	255,245	259,641	4,395	251,492	254,332	2,840
Jan-16	1,265,585	1,301,143	35,558	265,630	270,233	4,603	255,863	258,866	3,003
Feb-16	1,096,245	1,171,347	75,102	257,979	266,961	8,982	252,807	258,514	5,707
Mar-16	982,452	1,025,493	43,041	239,096	243,824	4,728	233,768	236,611	2,843
Apr-16	840,526	903,130	62,604	222,747	227,974	5,227	214,215	216,354	2,139
May-16	679,113	691,817	12,704	203,217	204,219	1,002	206,256	206,538	282
Jun-16	683,637	676,275	(7,362)	213,984	212,438	(1,546)	233,208	232,012	(1,196)
Jul-16	652,214	650,800	(1,414)	212,274	211,976	(297)	212,212	211,983	(229)
Aug-16	680,559	661,615	(18,944)	230,362	226,372	(3,990)	248,165	245,113	(3,052)
Sep-16	677,814	681,682	3,867	221,061	221,877	815	236,588	237,210	621
Total	10,227,817	10,470,786	242,970	2,746,109	2,768,657	22,548	2,798,486	2,809,733	11,247

	Large Demand GS (Sch. 12 & 26)			Primary GS (Sch. 10 & 31)			Seasonal Irrigation (Sch. 29)		
Month	Actual	Normalized	Adj.	Actual	Normalized	Adj.	Actual	Normalized	Adj.
Oct-15	154,975	155,048	73	109,054	109,133	79	880	880	-
Nov-15	143,957	143,437	(520)	93,118	92,662	(456)	331	331	-
Dec-15	165,139	165,647	508	124,261	124,708	447	377	377	-
Jan-16	153,083	153,641	558	99,517	100,006	489	317	317	-
Feb-16	168,575	169,528	952	117,569	118,421	852	315	315	-
Mar-16	148,884	149,312	428	106,099	106,487	387	205	205	-
Apr-16	146,171	146,326	155	92,950	93,118	168	297	297	-
May-16	139,684	139,699	15	94,592	94,612	20	779	779	-
Jun-16	156,577	155,837	(740)	107,947	107,629	(317)	1,636	1,588	(48)
Jul-16	164,669	164,527	(142)	98,943	98,882	(61)	2,319	2,309	(9)
Aug-16	171,591	169,682	(1,909)	144,891	144,074	(817)	2,954	2,827	(127)
Sep-16	177,375	177,766	391	109,649	109,816	167	2,554	2,580	26
Total	1,890,681	1,890,449	(232)	1,298,592	1,299,549	957	12,964	12,806	(159)

	Interrupt. Primary GS for Schools (Sch. 43)			Large General Service (Sch. 40)			Resale (Sch. 5)		
Month	Actual	Normalized	Adj.	Actual	Normalized	Adj.	Actual	Normalized	Adj.
Oct-15	7,756	8,225	469	50,620	50,649	29	348	371	24
Nov-15	8,770	8,101	(669)	43,261	42,991	(270)	486	467	(19)
Dec-15	14,247	14,896	649	65,045	65,307	262	804	823	18
Jan-16	13,574	14,252	678	55,614	55,900	287	972	990	18
Feb-16	14,545	15,866	1,321	47,324	47,822	498	936	976	40
Mar-16	12,237	12,931	694	37,308	37,531	223	812	836	23
Apr-16	10,276	11,041	765	46,511	46,586	75	706	743	37
May-16	8,335	8,481	146	51,542	51,547	5	463	471	8
Jun-16	7,484	7,418	(67)	43,092	42,873	(219)	378	377	(1)
Jul-16	5,786	5,773	(13)	60,478	60,436	(42)	326	326	(0)
Aug-16	7,533	7,362	(171)	77,043	76,476	(567)	284	281	(3)
Sep-16	5,842	5,877	35	51,509	51,621	112	282	283	1
Total	116,387	120,223	3,836	629,348	629,741	393	6,797	6,943	146

	Total		
Month	Actual	Normalized	Adj.
Oct-15	1,440,182	1,484,411	44,230
Nov-15	1,570,870	1,524,969	(45,900)
Dec-15	2,027,216	2,071,476	44,260
Jan-16	2,110,156	2,155,349	45,193
Feb-16	1,956,295	2,049,749	93,454
Mar-16	1,760,863	1,813,230	52,367
Apr-16	1,574,398	1,645,569	71,171
May-16	1,383,981	1,398,163	14,181
Jun-16	1,447,943	1,436,447	(11,496)
Jul-16	1,409,220	1,407,013	(2,207)
Aug-16	1,563,382	1,533,802	(29,580)
Sep-16	1,482,675	1,488,710	6,035
Total	19,727,181	20,008,888	281,707

Q. What is the effect of weather normalization on the electric revenue in the test year?

A. The positive adjustment to electric load had the effect of increasing pro forma revenue by $28,313,253, as shown on page 2 of the Fifth Exhibit to Prefiled Direct Testimony of Katherine J. Barnard, Exhibit No. ___(KJB-6).

Q. Is PSE's electric cost of service analysis and rate design study based on the weather-normalized sales?

A. Yes. Please see the Prefiled Direct Testimony of Jon A. Piliaris, Exhibit No. ___(JAP-1T), for an explanation of PSE's electric cost of service analysis and rate design study. PSE's electric cost of service analysis includes the temperature-adjusted power costs, and the electric rate design is based on the pro forma adjustment of energy sales made for the milder-than-normal winter and warmer-than-normal summer weather in the test year. In addition, the energy cost allocation factors used in PSE's electric cost of service analysis reflect the temperature-adjusted loads.

C. <u>Temperature Adjustment of Gas Sales</u>

Q. Please describe how the gas sales weather normalization was calculated.

A. The system-level temperature adjustment was calculated in total and allocated to each of the applicable classes by month based on the gas temperature adjustment methodology similar to the one used in PSE's 2011 GRC. The hourly temperature

and daily and monthly gas sales data used for modeling were updated for this proceeding.

Q. Please describe how the system-level gas throughput in the test year was normalized for weather.

A. As was done in PSE's 2011 GRC, PSE used the weather-sensitivity model coefficients based on actual daily load data and actual temperature at Sea-Tac to adjust system-level delivered gas loads (Firm, Interruptible and Transport) for weather. The weather-sensitivity model coefficients were estimated on the basis of the daily gas load and weather data compiled for the most current four-year period of 2012 through 2015. As with the electricity model, PSE's "normal" weather dataset was developed using the hourly temperature data recorded at Sea-Tac over the 30-year period from 1986 through 2015. Also consistent with the electricity model, the actual daily HDDs were calculated using the average of the 24 hourly temperatures compared against the base temperature. The amount of temperature adjustment was calculated by multiplying the weather sensitivity coefficients by the difference between the actual and normal HDDs. This calculation was performed on a monthly basis and aggregated for all of the HDD variables included in the system model.

Q. How did you allocate the temperature adjustment among gas rate schedules?

A. Initially, monthly gas usage patterns by rate schedule were evaluated to identify which rate classes are weather sensitive. Monthly histories of class gas sales and

HDDs were plotted for the most recent four years and the scattergrams were evaluated for any correlation between the changes in class gas sales and temperature. This analysis revealed that the following rate classes are temperature sensitive:

- Schedule 23 (Residential),
- Schedule 31 (Commercial, Industrial),
- Schedule 41 (Commercial, Industrial, Transport Commercial),
- Schedules 85 (Interruptible Commercial, Transport Commercial),
- Schedule 86 (Interruptible Commercial),
- Schedule 87 (Interruptible Commercial, Transport Commercial); and
- Special Contracts.

Econometric model equations were developed and estimated to characterize the relationship between monthly HDDs and average use per customer for each of the above weather sensitive classes. In order to secure a sufficient number of monthly observations for modeling, the historical data period for modeling was expanded to a five-tear period of 2011 through 2015. For each month of the test year, the amount of temperature adjustment to system total delivered load was then allocated to each of the applicable classes by taking the percentage share of each schedule's temperature adjustment relative to the sum of temperature adjustments for all weather sensitive schedules as calculated by the class sales normalization equations, and by then multiplying the system load temperature adjustment by this percentage share.

Q. Please summarize the final results of gas sales weather normalization.

A. Table 4 presents the temperature adjustment of sales by rate schedule. As shown in the table, applying the process described above to the test year sales to the weather sensitive rate schedules results in a total temperature adjustment of 83,004,480 therms. Because the test year winter was warmer than normal, this adjustment resulted in a pro forma delivered system load larger than actual load delivered during the test year. When the system temperature adjustment was allocated to the rate schedules, the gas sales to all of the weather-sensitive schedules were increased. The residential class represented 68.5 percent of the total temperature adjustment, increasing by 56,828,702 therms.

Table 4

Temperature Adjustment of Test Year Gas Sales by Rate Schedule

	Residential (Sch.23)			General service - commercial (Sch.31)			Large volume - commercial (Sch.41)			Trans. large volume - commercial (Sch.41T)		
Month	Actual	Normalized	Adjustments	Actual	Normalized	Adjustments	Actual	Normalized	Adjustments	Actual	Normalized	Adjustments
Oct-15	29,331,380	38,633,522	9,302,142	11,318,338	13,390,007	2,071,669	3,396,781	3,846,623	449,842	760,891	814,018	53,127
Nov-15	72,489,355	66,589,564	(5,899,791)	21,825,951	20,296,882	(1,529,069)	5,304,431	5,027,774	(276,657)	937,071	920,108	(16,963)
Dec-15	86,951,618	92,723,888	5,772,270	31,371,158	32,920,070	1,548,912	7,537,459	7,804,531	267,072	999,904	1,019,400	19,496
Jan-16	87,163,381	93,030,506	5,867,125	25,321,806	26,942,341	1,620,535	6,959,185	7,238,443	279,258	986,859	1,008,783	21,924
Feb-16	64,823,752	78,354,822	13,531,070	20,599,781	24,100,974	3,501,193	5,072,132	5,684,835	612,703	917,149	968,452	51,303
Mar-16	62,034,728	69,382,334	7,347,606	21,691,880	23,589,191	1,897,311	6,435,364	6,804,881	369,517	933,637	979,769	46,132
Apr-16	32,309,361	45,242,120	12,932,759	12,840,920	15,976,137	3,135,217	3,956,948	4,597,150	640,202	802,257	876,259	74,002
May-16	23,437,934	29,287,143	5,849,209	8,934,171	10,279,241	1,345,070	3,562,118	3,888,593	326,475	725,866	747,884	22,018
Jun-16	16,756,527	18,234,990	1,478,463	9,260,473	9,541,808	281,335	2,832,618	2,925,738	93,120	822,427	822,427	0
Jul-16	14,328,148	14,827,425	499,277	8,278,246	8,278,246	0	2,554,838	2,554,838	0	895,334	895,334	0
Aug-16	12,289,237	12,289,237	0	6,707,946	6,707,946	0	2,245,114	2,245,114	0	768,260	768,260	0
Sep-16	18,030,030	18,178,602	148,572	8,780,610	8,803,678	23,068	3,061,884	3,068,092	6,208	736,377	736,377	0
Test Year	519,945,450	576,774,152	56,828,702	186,931,281	200,826,522	13,895,241	52,918,873	55,686,613	2,767,740	10,286,032	10,557,071	271,039

	Trans. interrupt with firm option - com (Sch.85T)			Trans. non-exclus inter w/ firm option - com (Sch.87T)			Interruptible with firm option - com (Sch.85)			Limited interrupt w/ firm option - com (Sch.86)		
Month	Actual	Normalized	Adjustments	Actual	Normalized	Adjustments	Actual	Normalized	Adjustments	Actual	Normalized	Adjustments
Oct-15	1,969,987	2,101,472	131,485	1,401,283	1,610,465	209,182	1,209,198	1,372,014	162,816	482,823	683,061	200,238
Nov-15	2,212,321	2,167,607	(44,714)	1,907,649	1,807,240	(100,409)	1,105,020	1,044,763	(60,257)	967,013	899,317	(67,696)
Dec-15	2,368,684	2,421,698	53,014	2,169,714	2,265,701	95,987	1,617,854	1,693,359	75,505	1,488,947	1,567,689	78,742
Jan-16	2,299,432	2,357,409	57,977	2,056,259	2,177,068	120,809	1,709,818	1,797,521	87,703	985,224	1,075,738	90,514
Feb-16	1,981,894	2,086,372	104,478	1,681,517	1,960,296	278,779	1,410,358	1,602,231	191,873	913,739	1,129,074	215,335
Mar-16	1,629,403	1,723,717	94,314	1,934,245	2,102,384	168,139	1,444,404	1,569,116	124,712	1,131,517	1,259,954	128,437
Apr-16	2,301,220	2,455,838	154,618	1,376,208	1,673,010	296,802	572,145	781,049	208,904	584,040	803,702	219,662
May-16	1,858,778	1,946,467	87,689	1,273,969	1,430,664	156,695	826,542	927,780	101,238	419,090	531,783	112,693
Jun-16	1,745,751	1,768,353	22,602	1,151,746	1,151,746	0	544,768	579,157	34,389	322,890	375,053	52,163
Jul-16	1,534,734	1,534,734	0	1,091,625	1,091,625	0	2,208,869	2,208,869	0	239,033	239,033	0
Aug-16	1,731,819	1,731,819	0	1,053,948	1,053,948	0	1,283,748	1,283,748	0	164,459	164,459	0
Sep-16	1,740,292	1,740,292	0	1,096,161	1,096,161	0	388,224	388,224	0	312,046	319,451	7,405
Test Year	23,374,315	24,035,778	661,463	18,194,323	19,420,307	1,225,984	14,320,948	15,247,831	926,883	8,010,820	9,048,313	1,037,493

	Non-excl interrupt w/ firm option - com (Sch.87)			General service - industrial (Sch.31)			Large volume - industrial (Sch.41)			Special contracts - ind (Sch.SC)		
Month	Actual	Normalized	Adjustments	Actual	Normalized	Adjustments	Actual	Normalized	Adjustments	Actual	Normalized	Adjustments
Oct-15	555,836	744,103	188,267	698,404	980,888	282,484	1,002,601	1,045,328	42,727	2,610,707	3,027,029	416,322
Nov-15	1,792,448	1,721,159	(71,289)	1,457,955	1,300,003	(157,952)	925,674	907,456	(18,218)	3,814,970	3,648,271	(166,699)
Dec-15	2,575,980	2,669,123	93,143	2,190,668	2,340,818	150,150	1,418,347	1,434,089	15,742	3,984,679	4,144,982	160,303
Jan-16	2,671,871	2,776,218	104,347	1,978,831	2,137,484	158,653	974,169	993,119	18,950	4,055,477	4,261,189	205,712
Feb-16	3,816,976	4,032,868	215,892	1,412,880	1,779,495	366,615	872,758	908,133	35,375	3,421,158	3,926,997	505,839
Mar-16	582,916	696,655	113,739	1,567,864	1,767,818	199,954	1,189,330	1,217,207	27,877	3,687,973	4,026,747	338,774
Apr-16	1,149,447	1,359,673	210,226	835,445	1,214,171	378,726	875,318	925,477	50,159	2,710,026	3,334,824	624,798
May-16	2,242,967	2,336,655	93,688	645,669	858,420	212,751	840,810	868,418	27,608	2,400,467	2,691,047	290,580
Jun-16	1,467,666	1,467,666	0	418,037	508,792	90,755	778,289	778,289	0	2,165,598	2,246,508	80,910
Jul-16	1,381,412	1,381,412	0	395,030	465,748	70,718	712,383	712,383	0	2,019,080	2,019,080	0
Aug-16	1,407,221	1,407,221	0	418,332	418,332	0	753,289	753,289	0	1,782,675	1,782,675	0
Sep-16	1,154,701	1,154,701	0	500,616	512,544	11,928	846,004	846,004	0	2,001,842	2,022,223	20,381
Test Year	20,799,442	21,747,455	948,013	12,519,728	14,284,510	1,764,782	11,188,973	11,389,193	200,220	34,654,652	37,131,572	2,476,920

	Total weather normalized portion of volume		
Month	Actual	Normalized	Adjustments
Oct-15	54,738,230	68,248,531	13,510,301
Nov-15	114,739,858	106,330,144	(8,409,714)
Dec-15	144,675,013	153,005,349	8,330,336
Jan-16	137,162,313	145,795,820	8,633,507
Feb-16	106,924,095	126,534,550	19,610,455
Mar-16	104,263,261	115,119,773	10,856,512
Apr-16	60,313,333	79,239,408	18,926,075
May-16	47,168,381	55,794,095	8,625,714
Jun-16	38,266,790	40,400,527	2,133,737
Jul-16	35,638,731	36,208,726	569,995
Aug-16	30,606,045	30,606,045	0
Sep-16	38,648,789	38,866,351	217,562
Test Year	913,144,838	996,149,318	83,004,480

Q. What is the effect of the temperature adjustment on revenue for the test year in this proceeding?

A. The positive adjustment to volume had the effect of increasing pro forma revenue by $58,088,570 as shown on page 2 of the fifth exhibit to Prefiled Direct Testimony of Susan E. Free, Exhibit No. ___(SEF-6).

Q. Is PSE's gas cost of service analysis and rate design study based on the weather-normalized sales?

A. Yes. Please see the Prefiled Direct Testimony of Jon A. Piliaris, Exhibit No. ___(JAP-1T), for a description of PSE's gas cost of service analysis and rate design study. PSE's gas cost of service and rate design are based on the pro forma adjustment of gas sales made for the milder than normal test year weather. In addition, the gas energy cost allocation factors used in PSE's cost of service analysis reflect the temperature-adjusted loads.

III. CONCLUSION

Q. Does this conclude your testimony?

A. Yes, it does.