

**Exh. JL-2  
Docket UG-170929  
Witness: Jing Liu**

**BEFORE THE WASHINGTON  
UTILITIES AND TRANSPORTATION COMMISSION**

**WASHINGTON UTILITIES AND  
TRANSPORTATION COMMISSION,**

**Complainant,**

**v.**

**CASCADE NATURAL GAS  
CORPORATION,**

**Respondent.**

**DOCKET UG-170929**

**EXHIBIT TO  
TESTIMONY OF**

**Jing Liu**

**STAFF OF  
WASHINGTON UTILITIES AND  
TRANSPORTATION COMMISSION**

*Staff's Weather Normalization Regression Model Output*

**February 15, 2018**

**Staff's Weather Normalization Regression Model Output**

**Bellingham**

Dependent Variable: RESIUPC  
Method: Least Squares  
Date: 11/02/17 Time: 16:26  
Sample: 2007M01 2016M12  
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	21.00068	0.771654	27.21513	0
JAN*HDD60	0.139063	0.002796	49.74236	0
FEB*HDD60	0.123543	0.003506	35.23277	0
MAR*HDD60	0.119598	0.003782	31.61929	0
APR*HDD60	0.095952	0.005074	18.91045	0
MAY*HDD60	0.067663	0.009408	7.191893	0
OCT*HDD60	0.106557	0.006276	16.97921	0
NOV*HDD60	0.151022	0.003713	40.67264	0
DEC*HDD60	0.144452	0.002619	55.16451	0
R-squared	0.981637	Mean dependent var		58.2556
Adjusted R-squared	0.980314	S.D. dependent var		36.2371
S.E. of regression	5.084374	Akaike info criterion		6.16226
Sum squared resid	2869.445	Schwarz criterion		6.37132
Log likelihood	-360.7356	Hannan-Quinn criter.		6.24716
F-statistic	741.7191	Durbin-Watson stat		2.19639
Prob(F-statistic)	0	4-DW		1.80361
MAPE	9.2			

**Bellingham**

Dependent Variable: COMMUPC  
Method: Least Squares  
Date: 11/02/17 Time: 16:33  
Sample: 2007M01 2016M12  
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	123.9478	6.409507	19.33812	0
JAN*HDD60	0.502853	0.014811	33.95167	0
FEB*HDD60	0.432634	0.018564	23.30543	0
MAR*HDD60	0.385044	0.020029	19.22451	0
APR*HDD60	0.266021	0.026878	9.897304	0
MAY*HDD60	0.176693	0.049969	3.536072	0.0006
OCT*HDD60	0.338301	0.033129	10.2115	0
NOV*HDD60	0.482201	0.019544	24.67263	0
DEC*HDD60	0.463548	0.013775	33.65114	0
TREND	-0.206104	0.072138	-2.85708	0.0051
R-squared	0.957839	Mean dependent var		233.583
Adjusted R-squared	0.95439	S.D. dependent var		125.183
S.E. of regression	26.73481	Akaike info criterion		9.48947
Sum squared resid	78622.52	Schwarz criterion		9.72176
Log likelihood	-559.3679	Hannan-Quinn criter.		9.5838
F-statistic	277.6743	Durbin-Watson stat		2.25666
Prob(F-statistic)	0	4-DW		1.74335
MAPE	9.84			

**Bremerton**

Dependent Variable: RESIUPC  
Method: Least Squares  
Date: 01/23/18 Time: 16:19  
Sample: 2007M01 2016M12  
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	17.35979	0.859276	20.2028	0
JAN*HDD60	0.148781	0.002729	54.51164	0
FEB*HDD60	0.130124	0.003385	38.44302	0
MAR*HDD60	0.130397	0.003622	36.00253	0
APR*HDD60	0.114924	0.005026	22.86441	0
MAY*HDD60	0.096819	0.009544	10.145	0
JUN*HDD60	0.101531	0.023242	4.368419	0
SEP*HDD60	0.087902	0.036245	2.425237	0.0169
OCT*HDD60	0.133908	0.006971	19.21018	0
NOV*HDD60	0.166506	0.003666	45.41522	0
DEC*HDD60	0.153476	0.002572	59.66551	0
R-squared	0.98553	Mean dependent var	57.289	
Adjusted R-squared	0.984202	S.D. dependent var	36.0516	
S.E. of regression	4.531341	Akaike info criterion	5.9471	
Sum squared resid	2238.102	Schwarz criterion	6.20262	
Log likelihood	-345.8261	Hannan-Quinn criter.	6.05087	
F-statistic	742.3566	Durbin-Watson stat	2.13974	
Prob(F-statistic)	0			
MAPE	7.63			

**Bremerton**

Dependent Variable: COMMUPC  
Method: Least Squares  
Date: 01/23/18 Time: 16:21  
Sample: 2007M01 2016M12  
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	147.5006	7.967074	18.51378	0
JAN*HDD60	0.667843	0.017282	38.64305	0
FEB*HDD60	0.556329	0.021397	26.00014	0
MAR*HDD60	0.521577	0.022901	22.77573	0
APR*HDD60	0.387488	0.031825	12.17543	0
MAY*HDD60	0.317479	0.060333	5.262111	0
JUN*HDD60	0.318851	0.147718	2.15851	0.0331
SEP*HDD60	0.468625	0.2278	2.057176	0.0421
OCT*HDD60	0.556966	0.043902	12.68664	0
NOV*HDD60	0.656553	0.022971	28.58236	0
DEC*HDD60	0.631355	0.016103	39.20783	0
TREND	-0.17546	0.077578	-2.26174	0.0257
R-squared	0.969812	Mean dependent var	299.795	
Adjusted R-squared	0.966737	S.D. dependent var	155.016	
S.E. of regression	28.27201	Akaike info criterion	9.61626	
Sum squared resid	86325.11	Schwarz criterion	9.89501	
Log likelihood	-564.9757	Hannan-Quinn criter.	9.72946	
F-statistic	315.4152	Durbin-Watson stat	2.30299	
Prob(F-statistic)	0			
MAPE	8.09			

**Hoquiam (For Reference Only)**

Dependent Variable: RESIUPC  
Method: ARMA Conditional Least Squares (Marquardt - EViews legacy)  
Date: 11/03/17 Time: 13:57  
Sample (adjusted): 2007M02 2016M12  
Included observations: 119 after adjustments  
Convergence achieved after 7 iterations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	18.36724	1.305531	14.06879	0
JAN*HDD60	0.165423	0.004105	40.29331	0
FEB*HDD60	0.142882	0.004926	29.00853	0
MAR*HDD60	0.135352	0.004935	27.42597	0
APR*HDD60	0.106009	0.006044	17.53949	0
MAY*HDD60	0.072262	0.008915	8.105634	0
JUN*HDD60	0.05196	0.01543	3.367455	0.0011
OCT*HDD60	0.133169	0.007721	17.2469	0
NOV*HDD60	0.180358	0.004831	37.33281	0
DEC*HDD60	0.168428	0.003576	47.09435	0
AR(1)	0.46948	0.08497	5.525251	0
R-squared	0.981204	Mean dependent var	56.7455	
Adjusted R-squared	0.979463	S.D. dependent var	35.7069	
S.E. of regression	5.11704	Akaike info criterion	6.19091	
Sum squared resid	2827.883	Schwarz criterion	6.44781	
Log likelihood	-357.3592	Hannan-Quinn criter.	6.29523	
F-statistic	563.776	Durbin-Watson stat	2.20378	
Prob(F-statistic)	0			
Inverted AR Roots	0.47			
MAPE	9.84			

**Hoquiam (For Reference Only)**

Dependent Variable: COMMUPC  
Method: Least Squares  
Date: 11/03/17 Time: 14:04  
Sample: 2007M01 2016M12  
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	169.3968	7.486557	22.62679	0
JAN*HDD60	0.734129	0.021052	34.87162	0
FEB*HDD60	0.590218	0.025575	23.0775	0
MAR*HDD60	0.517728	0.025896	19.99222	0
APR*HDD60	0.32491	0.03242	10.02193	0
MAY*HDD60	0.189944	0.050669	3.748732	0.0003
OCT*HDD60	0.534933	0.050056	10.68662	0
NOV*HDD60	0.695546	0.027325	25.45417	0
DEC*HDD60	0.679207	0.019205	35.36698	0
TREND	-0.344939	0.085804	-4.020056	0.0001
R-squared	0.960211	Mean dependent var	299.795	
Adjusted R-squared	0.956956	S.D. dependent var	155.016	
S.E. of regression	32.16131	Akaike info criterion	9.85906	
Sum squared resid	113778.5	Schwarz criterion	10.0914	
Log likelihood	-581.5436	Hannan-Quinn criter.	9.9534	
F-statistic	294.9566	Durbin-Watson stat	1.71714	
Prob(F-statistic)	0	4-DW	2.28286	
MAPE	9.61			

**Walla Walla**

Dependent Variable: RESIUPC  
Method: Least Squares  
Date: 11/03/17 Time: 14:30  
Sample: 2007M01 2016M12  
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	18.0903	1.005692	17.98792	0
JAN*HDD60	0.123367	0.002033	60.68452	0
FEB*HDD60	0.121247	0.002738	44.2889	0
MAR*HDD60	0.123925	0.003709	33.41226	0
APR*HDD60	0.092058	0.005799	15.87352	0
MAY*HDD60	0.06958	0.01609	4.324377	0
OCT*HDD60	0.07167	0.007154	10.01749	0
NOV*HDD60	0.091897	0.002874	31.9798	0
DEC*HDD60	0.114927	0.001881	61.09524	0
TREND	-0.061458	0.0116	-5.298108	0
R-squared	0.986241	Mean dependent var	46.726	
Adjusted R-squared	0.985115	S.D. dependent var	35.4332	
S.E. of regression	4.322984	Akaike info criterion	5.84542	
Sum squared resid	2055.701	Schwarz criterion	6.07772	
Log likelihood	-340.7255	Hannan-Quinn criter.	5.93976	
F-statistic	876.0754	Durbin-Watson stat	2.33541	
Prob(F-statistic)	0	4-DW	1.66459	
MAPE	10.53			

**Walla Walla**

Dependent Variable: COMMUPC  
Method: Least Squares  
Date: 11/03/17 Time: 14:41  
Sample: 2007M01 2016M12  
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	158.0489	7.282339	21.70305	0
JAN*HDD60	0.651244	0.015331	42.47918	0
FEB*HDD60	0.607948	0.02065	29.44111	0
MAR*HDD60	0.569954	0.027976	20.37302	0
APR*HDD60	0.339359	0.043759	7.755224	0
OCT*HDD60	0.400254	0.054035	7.407356	0
NOV*HDD60	0.464838	0.021704	21.41729	0
DEC*HDD60	0.564624	0.014209	39.73788	0
TREND	-0.629466	0.088198	-7.136979	0
R-squared	0.970095	Mean dependent var	277.701	
Adjusted R-squared	0.96794	S.D. dependent var	184.683	
S.E. of regression	33.06824	Akaike info criterion	9.90706	
Sum squared resid	121379.4	Schwarz criterion	10.1161	
Log likelihood	-585.4237	Hannan-Quinn criter.	9.99196	
F-statistic	450.0916	Durbin-Watson stat	1.58182	
Prob(F-statistic)	0	4-DW	2.41818	
MAPE	12.08			

**Yakima**

Dependent Variable: RESIUPC  
Method: Least Squares  
Date: 11/03/17 Time: 15:47  
Sample: 2007M01 2016M12  
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.40952	1.002979	10.3786	0
JAN*HDD60	0.122764	0.001665	73.73006	0
FEB*HDD60	0.127818	0.002341	54.59163	0
MAR*HDD60	0.118564	0.002877	41.21207	0
APR*HDD60	0.09455	0.004464	21.1819	0
MAY*HDD60	0.087765	0.011809	7.431852	0
OCT*HDD60	0.05504	0.004755	11.57595	0
NOV*HDD60	0.092928	0.002278	40.79199	0
DEC*HDD60	0.112366	0.001519	73.95514	0
TREND	0.050259	0.011338	4.432766	0
R-squared	0.990506	Mean dependent var		52.2788
Adjusted R-squared	0.98973	S.D. dependent var		41.1379
S.E. of regression	4.169043	Akaike info criterion		5.77291
Sum squared resid	1911.901	Schwarz criterion		6.0052
Log likelihood	-336.3743	Hannan-Quinn criter.		5.86724
F-statistic	1275.187	Durbin-Watson stat		1.74496
Prob(F-statistic)	0	4-DW		2.25504
MAPE	11.51			

**Yakima**

Dependent Variable: COMMUPC  
Method: Least Squares  
Date: 11/03/17 Time: 15:53  
Sample: 2007M01 2016M12  
Included observations: 120

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	91.38693	8.668761	10.5421	0
JAN*HDD60	0.665151	0.013634	48.78556	0
FEB*HDD60	0.639389	0.019164	33.36434	0
MAR*HDD60	0.54655	0.023549	23.20932	0
APR*HDD60	0.380915	0.036514	10.43189	0
MAY*HDD60	0.330316	0.096381	3.427192	0.0009
SEP*HDD60	0.55213	0.253968	2.174017	0.0319
OCT*HDD60	0.468609	0.038855	12.0605	0
NOV*HDD60	0.486245	0.018612	26.12531	0
DEC*HDD60	0.557742	0.012408	44.94934	0
TREND	0.392883	0.091911	4.274621	0
R-squared	0.976971	Mean dependent var		315.171
Adjusted R-squared	0.974859	S.D. dependent var		210.594
S.E. of regression	33.39171	Akaike info criterion		9.94168
Sum squared resid	121535.7	Schwarz criterion		10.1972
Log likelihood	-585.5009	Hannan-Quinn criter.		10.0455
F-statistic	462.4256	Durbin-Watson stat		1.89355
Prob(F-statistic)	0	4-DW		2.10645
MAPE	11.43			