Exhibit No. BTC-10
Dockets UE-151871/UG-151872
Witness: Bradley T. Cebulko

BEFORE THE WASHINGTON
UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, Complainant, v. PUGET SOUND ENERGY, Respondent.	DOCKETS UE-151871/UG-151872 (consolidated)

EXHIBIT TO TESTIMONY OF

BRADLEY T. CEBULKO

STAFF OF
WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION

Excerpt from Department of Energy's Energy Efficiency and Renewable Energy Office – Residential Furnace Life-Cycle Cost and Payback Period Analysis

June 7, 2016

Input Parameters

	1 NWGF	2 MHGF
from: Bldg Sample		
Repl. Or New? (1=Repl, 2=New + New Owner)	1	2
Census Region	3	2
Number of Floors	1	
Number of Floors above Furnace	0	
High Roof	0	
High Ceiling (1=Yes; 0= No)	1	
High Ceiling (Height, NAHB Data)	[redacted]	
Avg. Floor Height	10	
Estimated Average Wall Length	24.7	
Avg Wall / Horiz Vent Length Ratio	[redacted]	
Avg Wall / Horiz Vent Length Ratio (New Const.)	[redacted]	
Common Wall with Other House/Apart.	[redacted]	
Multi-Family or Attached Home (Additional Horizontal Le	0	
Installation Location	7	5
Indoor Furnace Installed on Bottom Floor	[redacted]	
House Type	2	1
Installation Heated SQFT	2444	2128
Has CAC Equipment	1	1
Separate WH	1	
AFUE Existing (rated)	90%	80%
Basecase Efficiency (AFUE)	80%	92%
HH Year Built	1998	1998
Equipment Age (years)	4	11
Massive Wall (for PVC pipe hole cost)	1	
Lifetime	27	27
Year of next replacement	2031	2024

New Owner/Switching Fraction for NWGF (10% from NIA) [redacted]

Export Parameters

IPrd	Product Class	Eff. Level	Basic Installation (2013 $)	Venting Costs (2013 $)	Orphaned WH (2013 $)	Condensate Drainage (2013 $)	Installation Costs (2013 $)
1	NWGF 80%	0	[redacted]	[redacted]	[redacted]	[redacted]	$478
1	NWGF 90%	1	[redacted]	[redacted]	[redacted]	[redacted]	$817
1	NWGF 92%	2	[redacted]	[redacted]	[redacted]	[redacted]	$817
1	NWGF 95%	3	[redacted]	[redacted]	[redacted]	[redacted]	$817
1	NWGF 98%	4	[redacted]	[redacted]	[redacted]	[redacted]	$817
2	MHGF 80%	0	[redacted]	[redacted]	[redacted]	[redacted]	$779
2	MHGF 92%	1	[redacted]	[redacted]	[redacted]	[redacted]	$591
2	MHGF 95%	2	[redacted]	[redacted]	[redacted]	[redacted]	$591
2	MHGF 97%	3	[redacted]	[redacted]	[redacted]	[redacted]	$591

Fuel Switching Costs	Basic	Electrical	Orphaned WH	Total
EF	[redacted]	[redacted]		$1,073.62
CAC	$430.78			$430.78
AH Only + Elec Resistance Elements	$460.48	$613.14		$1,073.62
AH/HP	$430.78			$430.78
GWH	$460.48			$460.48
EWH	$460.48	[redacted]		$580.97
Orphaned WH			$0	

Calculations

Vent Length Calculation

	4" NWGF	4" MHGF
Vertical Installation		
Vertical Vent Length	9.0	3.0
Horizontal Vent Length	0.0	0.0
Total Vent Length (Vertical Installation)	9.0	3.0
Horizontal Installation		
Vertical Vent Length	1.0	3.0
Horizontal Vent Length	8.4	0.0
Total Vent Length (Horizontal Installation)	9	3
Horizontal or Vertical? (1=Horizontal, 2 = Vertical)	2	2

Misc.

	NWGF	MHGF
Elbows (Retrofit)	[redacted]	0
Elbows (New Construction)	[redacted]	0
Direct Vent Installation by Location (1= Direct Vent; 0 =	0	1
Common Venting Installation Inter. Variable	0	
Common Venting Installations (1 = Common; 0 = Separ	0	
Chimney Venting fraction for Retrofits (1=Chimney; 0=M	0	
Chimney vented Furnace Replaced or Installed betweer	0	
Chimney vented Furnace to be Replaced or Installed be	0	
Needs Chimney Relining (0=No; 1=Yes)	0	
Resizing Scenarios		
Furnace Replaced or Installed between 1995 and 2009	1	
Furnace to be Replaced or Installed between 2009 and	0	
Venting Resizing Criteria (Last Furnace replacement be	0	
1) Category 1 Venting (Vent Connector)	0	
2) Category 1 Venting (Vent System)	0	
3) 90% AFUE (Vent Connector for Orphaned WH with	0	
4) 90% AFUE (Vent System for Orphaned WH with old	0	
5) 90% AFUE (Vent System for Orphaned WH with nev	0	
Condensing Option?	1	1

Assumption Definition

Direct Vent Installation by Location (1= Direct Vent; 0 = Single Pipe)

ID	Installation Location	Distr.	Assump.
1	Basement (Conditioned)	[redacted]	67%
2	Basement (Unconditioned)	[redacted]	33%
3	Crawlspace	0	33%
4	Garage	1	100%
5	Other	[redacted]	67%
6	Attic (Conditioned)	1	67%
7	Attic (Unconditioned)	0	33%

Common Venting Installations (1 = Common; 0 = Separate)

ID	Census Region	Distr.	Assump.
1	Northeast	[redacted]	78.0%
2	Midwest	[redacted]	88.0%
3	South	[redacted]	22.0%
4	West	[redacted]	65.0%

Chimney Venting fraction for Retrofits (1=Chimney; 0=Metal Vent)

ID	Installation Location	Distr.	Assump.
1	Northeast	[redacted]	73%
2	Midwest	[redacted]	53%
3	South	[redacted]	10%
4	West	[redacted]	27%

Resizing Scenarios

	Distr.	Assump.
1) 80% AFUE (New Vent Connector with old vent)	[redacted]	75%

Installation Cost Components

Description of Cost	NWGF	MHGF
Basic Installation		
Putting in Place & Setting Up Eqpmt	$398	$459
Attic Installation Adder	$30	$0
Permit & Removal/Disposal Fees	$50	$50
Conventional Metal Venting Installation Costs (80%+ AFUE)		
Resizing Vent	$0	
Resizing Vent (Connector Only)	$0	
New Vent System (New Construction)	$0	$270
Chimney Relining	$0	
Stainless Steel Venting Installation Costs (80%+ AFUE)		
New Stainless Steel Venting		
Plastic Venting Installation Costs (80%+ AFUE)		
Flue Venting (Plastic Vent)	$184	$32
Concealing Plastic Venting (Retrofit Only)	$0	
Combustion Air Pipe (Direct Vent)	$0	$32
Orphaned Water Heater		
Chimney Relining for Orphaned Water Heater	$0	
Resizing (System) for Orphaned Water Heater	$0	
Resizing (Vent Connector Only) for Orphaned Water Heater	$0	
Condensate Drainage (90% and above AFUE)		
Electricity Connection	$0	$0
Condensate Pump	$0	
Condensate Heat Tape (Freeze Protection)	$91	$0
Condensate Drain Pan	$45	
Condensate Pipe	$18	$17
Condensate Neutralizer	$0	$0

Source: See Appendix B-D

2) 80% AFUE (New Vent System with old vent)	[redacted]	20%
3) 90% AFUE (Vent Connector for Orphaned WH with		100%
4) 90% AFUE (Vent System for Orphaned WH with old		75%
5) 90% AFUE (Vent System for Orphaned WH with new		40%

Installation Applicability Fraction by Housing Type & Installation Location

	Distr.	Assump.
Fraction of Concealing P\	50% of indoor and bldgs sha	50%
Electric Outlet Required fr	50% of all installations	50%
Condensate Pump	25% of installations w/o CAC	25%
Condensate Neutralizer	12.5% of all installations	12.5%
Condensate Heat Tape	50% of uncond. attic installat	50%

Forecast Cells

	Rest of Country	NWGF North	National	MHGF
Replacements				
Basic Installation - Replacement	[redacted]			
Resizing Vent				
Resizing Vent (Connector Only)				
Chimney Relining				
Stainless Steel Venting Installation Costs (80%+ AFUE)				
Flue Venting (Plastic Vent)				
Concealing Plastic Venting (Retrofit Only)				
Combustion Air Pipe (Direct Vent)				
Chimney Relining for Orphaned Water Heater				
Resizing (System) for Orphaned Water Heater				
Resizing (Vent Connector Only) for Orphaned Water Heater				
Electricity Connection				
Condensate Pump				
Condensate Heat Tape (Freeze Protection)				
Condensate Drain Pan				
Condensate Pipe				
Condensate Neutralizer				

Determination of Electrical Panel Requirements	
New Electrical Panel is needed?	1
Building Year Built	1998