EXHIBIT A

BEFORE THE

WASHINGTON UTILITIES & TRANSPORTATION COMMISSION

NW NATURAL

SUPPORTING MATERIALS

WA EE PROGRAM COSTS (CURRENT & HISTORICAL)

NWN WUTC Advice No. 25-04 / UG-_____

September 15, 2025

NW NATURAL

EXHIBIT A

Supporting Material

WA EE PROGRAM COSTS (CURRENT & HISTORICAL)

NWN WUTC ADVICE NO. 25-04 / UG-_____

NW Natural
Rates & Regulatory Affairs
2025-2026 PGA Filing - Washington: September Filing
Calculation of Increments Allocated on the EQUAL PERCENTAGE OF MARGIN BASIS

												FORECAST			DEFERRAL - Gas Actg			HISTORICAL - Calculation		
												R&C Energy Efficiency Programs - Forecast			**R&C Energy Efficiency Programs - Deferral**			**R&C Energy Efficiency Programs - Historical**		
		PGA	Billing Rate from	WACOG & Demand from	Temps from Temporary						Proposed Amount:	5,254,526	Temporary Increments		(65,076)	Temporary Increments		0	Allocated to Rate Schedules	
		Volumes page	Rates page,	Rates page,	ncrement page	**MARGIN**	Volumetric	**Customer**		**Total**	Revenue Sensitive Multiplier:	4.357%	add revenue sensitive factor		4.357%	add revenue sensitive factor		4.357%	add revenue sensitive factor	
		Column D	Column A	Column B+C+E	Column A	**Rate**	Margin	**Charge**	Customers	**Margin**	Amount to Amortize:	**5,493,890**	All Residential and Commercial sales		**(68,040)**	All Residential and Commercial sales		**0**	All Residential and Commercial sales	
						E=B-C-D						**Multiplier**	Allocation to R	Increment	**Multiplier**	Allocation to R	Increment	**Multiplier**	Allocation to F	Increment
Schedule	Block	**A**	**B**	**C**	**D**	**E**	**F = E * A**	**G**	**H**	**I = (G*H*12)+F**		**J**	**K**	**L**	**J**	**K**	**L**	**J**	**K**	**L**
1R		179,824	$1.66830	$0.53611	$0.29750	$0.83469	$150,097	$5.50	1,884	$274,441		1.0	$25,874	$0.14389	1.0	($320)	($0.00178)	1.0	$0	$0.00000
1C		18,807	$1.67264	$0.53611	$0.27345	$0.86308	$16,232	$7.00	36	$19,256		1.0	$1,815	$0.09651	1.0	($22)	($0.00117)	1.0	$0	$0.00000
2R		59,991,192	$1.31527	$0.53611	$0.22096	$0.55820	$33,487,083	$8.00	89,230	$42,053,163		1.0	$3,964,723	$0.06609	1.0	($49,102)	($0.00082)	1.0	$0	$0.00000
3 CFS		21,359,579	$1.27854	$0.53611	$0.20893	$0.53350	$11,395,335	$22.00	6,828	$13,197,927		1.0	$1,244,285	$0.05825	1.0	($15,410)	($0.00072)	1.0	$0	$0.00000
3 IFS		192,102	$1.23031	$0.53611	$0.15035	$0.54385	$104,475	$22.00	20	$109,755		0.0	$0	$0.00000	0.0	$0	$0.00000	0.0	$0	$0.00000
27		34,823	$1.11591	$0.53611	$0.26727	$0.31253	$10,883	$9.00	403	$54,407		1.0	$5,129	$0.14729	1.0	($64)	($0.00184)	1.0	$0	$0.00000
41C Firm Sales	Block 1	1,665,389	$1.03949	$0.43274	$0.19067	$0.41608	$1,682,279	$250	101	$1,985,279		1.0	$187,170	$0.04629	1.0	($2,318)	($0.00057)	1.0	$0	$0.00000
	Block 2	2,698,481	$0.98116	$0.43274	$0.18179	$0.36663						1.0		$0.04079	1.0		($0.00051)	1.0		$0.00000
41I Firm Sales	Block 1	331,379	$0.94622	$0.43274	$0.14201	$0.37147	$317,352	$250.00	21	$380,352		0.0	$0	$0.00000	0.0	$0	$0.00000	0.0	$0	$0.00000
	Block 2	593,487	$0.89909	$0.43274	$0.13904	$0.32731						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
41C Interr Sales	Block 1	0	$0.96427	$0.43274	$0.14700	$0.38453	$0	$250.00	0	$0		1.0	$0	$0.04233	1.0	$0	($0.00052)	1.0	$0	$0.00000
	Block 2	0	$0.91047	$0.43274	$0.13893	$0.33880						1.0		$0.03729	1.0		($0.00046)	1.0		$0.00000
41I Interr Sales	Block 1	0	$0.90245	$0.43274	$0.10593	$0.36378	$0	$250.00	0	$0		0.0	$0	$0.00000	0.0	$0	$0.00000	0.0	$0	$0.00000
	Block 2	0	$0.85609	$0.43274	$0.10285	$0.32050						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
41C Firm Trans	Block 1	123,243	$0.64044	$0.00000	$0.26259	$0.37785	$141,405	$500.00	8	$189,405		0.0	$0	$0.00000	0.0	$0	$0.00000	0.0	$0	$0.00000
	Block 2	284,875	$0.59302	$0.00000	$0.26011	$0.33291						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
41I Firm Trans	Block 1	0	$0.62856	$0.00000	$0.26075	$0.36781	$0	$500.00	0	$0		0.0	$0	$0.00000	0.0	$0	$0.00000	0.0	$0	$0.00000
	Block 2	0	$0.58256	$0.00000	$0.25850	$0.32406						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
42C Firm Sales	Block 1	820,213	$0.79626	$0.43274	$0.15742	$0.20610	$395,334	$1,300.00	8	$520,134		1.0	$49,038	$0.02557	1.0	($607)	($0.00032)	1.0	$0	$0.00000
	Block 2	926,223	$0.77027	$0.43274	$0.15305	$0.18448						1.0		$0.02288	1.0		($0.00028)	1.0		$0.00000
	Block 3	323,675	$0.71863	$0.43274	$0.14439	$0.14150						1.0		$0.01755	1.0		($0.00022)	1.0		$0.00000
	Block 4	84,983	$0.68461	$0.43274	$0.13869	$0.11318						1.0		$0.01404	1.0		($0.00017)	1.0		$0.00000
	Block 5	0	$0.63927	$0.43274	$0.13108	$0.07545						1.0		$0.00936	1.0		($0.00012)	1.0		$0.00000
	Block 6	0	$0.58259	$0.43274	$0.12157	$0.02828						1.0		$0.00351	1.0		($0.00004)	1.0		$0.00000
42I Firm Sales	Block 1	887,030	$0.73169	$0.43274	$0.13254	$0.16641	$261,822	$1,300.00	12	$449,022		0.0	$0	$0.00000	0.0	$0	$0.00000	0.0	$0	$0.00000
	Block 2	668,287	$0.71258	$0.43274	$0.13089	$0.14895						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 3	109,048	$0.67457	$0.43274	$0.12761	$0.11422						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 4	24,233	$0.64957	$0.43274	$0.12545	$0.09138						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 5	0	$0.61626	$0.43274	$0.12258	$0.06094						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 6	0	$0.57455	$0.43274	$0.11898	$0.02283						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
42C Firm Trans	Block 1	122,544	$0.40332	$0.00000	$0.24890	$0.15442	$112,991	$1,550.00	1	$131,591		0.0	$0	$0.00000	0.0	$0	$0.00000	0.0	$0	$0.00000
	Block 2	245,088	$0.38640	$0.00000	$0.24816	$0.13824						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 3	245,088	$0.35269	$0.00000	$0.24669	$0.10600						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 4	403,344	$0.33054	$0.00000	$0.24573	$0.08481						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 5	0	$0.30097	$0.00000	$0.24443	$0.05654						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 6	0	$0.26403	$0.00000	$0.24283	$0.02120						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
42I Firm Trans	Block 1	933,452	$0.40096	$0.00000	$0.24935	$0.15161	$734,029	$1,550.00	10	$920,029		0.0	$0	$0.00000	0.0	$0	$0.00000	0.0	$0	$0.00000
	Block 2	1,354,332	$0.38427	$0.00000	$0.24856	$0.13571						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 3	1,182,765	$0.35105	$0.00000	$0.24699	$0.10406						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 4	2,743,941	$0.32922	$0.00000	$0.24596	$0.08326						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 5	1,030,134	$0.30009	$0.00000	$0.24459	$0.05550						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 6	0	$0.26369	$0.00000	$0.24287	$0.02082						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
42C Interr Sales	Block 1	237,824	$0.71133	$0.43274	$0.10987	$0.16872	$136,973	$1,300.00	2	$168,173		1.0	$15,855	$0.01953	1.0	($196)	($0.00024)	1.0	$0	$0.00000
	Block 2	449,890	$0.69043	$0.43274	$0.10666	$0.15103						1.0		$0.01748	1.0		($0.00022)	1.0		$0.00000
	Block 3	201,897	$0.64878	$0.43274	$0.10024	$0.11580						1.0		$0.01340	1.0		($0.00017)	1.0		$0.00000
	Block 4	59,596	$0.62141	$0.43274	$0.09603	$0.09264						1.0		$0.01072	1.0		($0.00013)	1.0		$0.00000
	Block 5	0	$0.58493	$0.43274	$0.09041	$0.06178						1.0		$0.00715	1.0		($0.00009)	1.0		$0.00000
	Block 6	0	$0.53925	$0.43274	$0.08334	$0.02317						1.0		$0.00268	1.0		($0.00003)	1.0		$0.00000
42I Interr Sales	Block 1	171,533	$0.69064	$0.43274	$0.09437	$0.16353	$32,008	$1,300.00	1	$47,608		0.0	$0	$0.00000	0.0	$0	$0.00000	0.0	$0	$0.00000
	Block 2	27,036	$0.67199	$0.43274	$0.09287	$0.14638						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 3	0	$0.63489	$0.43274	$0.08990	$0.11225						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 4	0	$0.61048	$0.43274	$0.08793	$0.08981						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 5	0	$0.57791	$0.43274	$0.08531	$0.05986						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 6	0	$0.53724	$0.43274	$0.08206	$0.02244						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
42C Inter Trans	Block 1	0	$0.39076	$0.00000	$0.24907	$0.14169	$0	$1,550.00	0	$0		0.0	$0	$0.00000	0.0	$0	$0.00000	0.0	$0	$0.00000
	Block 2	0	$0.37516	$0.00000	$0.24831	$0.12685						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 3	0	$0.34405	$0.00000	$0.24678	$0.09727						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 4	0	$0.32360	$0.00000	$0.24578	$0.07782						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 5	0	$0.29633	$0.00000	$0.24444	$0.05189						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 6	0	$0.26221	$0.00000	$0.24277	$0.01944						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
42I Inter Trans	Block 1	952,237	$0.39347	$0.00000	$0.24917	$0.14430	$931,613	$1,550.00	10	$1,117,613		0.0	$0	$0.00000	0.0	$0	$0.00000	0.0	$0	$0.00000
	Block 2	1,827,775	$0.37758	$0.00000	$0.24841	$0.12917						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 3	1,364,376	$0.34592	$0.00000	$0.24687	$0.09905						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 4	4,116,253	$0.32511	$0.00000	$0.24586	$0.07925						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 5	1,831,129	$0.29736	$0.00000	$0.24452	$0.05284						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
	Block 6	0	$0.26266	$0.00000	$0.24285	$0.01981						0.0		$0.00000	0.0		$0.00000	0.0		$0.00000
43 Firm Trans		0	$0.24685	$0.00000	$0.24194	$0.00491	$0	$38,000.00	0	$0		0.0	$0	$0.00000	0.0	$0	$0.00000	0.0	$0	$0.00000
43 Interr Trans		0	$0.24685	$0.00000	$0.24194	$0.00491	$0	$38,000.00	0	$0		0.0	$0	$0.00000	0.0	$0	$0.00000	0.0	$0	$0.00000
Intentionally blank																				
Totals		##########					$49,909,911			$61,618,155		$58,272,780	$5,493,889		$58,272,780	($68,039)		$58,272,780	$0	

Sources for line 2 above:

Inputs page	Column G	Line 37		Line 45		Line 45	
Tariff Schedules:							
Schedule #		Sched 215		Sched 215		Sched 215	

Note: Allocation to rate schedules or blocks with zero volumes is calculated on an overall margin percentage change basis.

NW Natural
Rates & Regulatory Affairs
2025-2026 PGA Filing - Washington: September Filing
Effects on Average Bill by Rate Schedule
Calculation of Effect on Customer Average Bill by Rate Schedule [1] [3]

			Washington PGA Normalized Volumes page, Column D	Therms in Block	Normal Therms Monthly Average use	Minimum Monthly Charge	Current CCA Monthly Avg. Credit	Current Net Minimum Monthly Charge	Proposed CCA Monthly Avg. Credit	Proposed Net Minimum Monthly Charge	Current 1/1/2025 Billing Rates	11/1/2026 Current Average Bill[2]	Proposed 11/1/2026 Rates [3]	Proposed 11/1/2026 R&C Energy Eff. Average Bill	Proposed 11/1/2026 % Bill Change
												F=D+(C * E)		H=D+(C * G)	
	Schedule	Block	A	B	C			D			E	F	G	H	I
7	1R		179,824	N/A	8.0	$5.50	$1.82	$3.68	$1.82	$3.68	$1.66830	$17.03	$1.69995	$17.28	1.5%
8	1C		18,807	N/A	44.0	$7.00	$5.34	$1.66	$5.34	$1.66	$1.67264	$75.25	$1.67215	$75.23	0.0%
9	2R		59,991,192	N/A	56.0	$8.00	$10.54	($2.54)	$10.54	($2.54)	$1.31527	$71.11	$1.31686	$71.20	0.1%
10	3 CFS		21,359,579	N/A	261.0	$22.00	$48.32	($26.32)	$48.32	($26.32)	$1.27854	$307.38	$1.27948	$307.62	0.1%
11	3 IFS		192,102	N/A	800.0	$22.00	$129.16	($107.16)	$129.16	($107.16)	$1.23031	$877.09	$1.23031	$877.09	0.0%
12	27		34,823	N/A	7.0	$9.00	$0.00	$9.00	$0.00	$9.00	$1.11591	$16.81	$1.16931	$17.19	2.3%
13	41C Firm Sales	Block 1	1,665,389	2,000	3,601.0	$250.00	$515.09	($265.09)	$515.09	($265.09)	$1.03949		$1.03971		
14		Block 2	2,698,481	all additional							$0.98116		$0.98135		
15		**TOTAL**										**$3,384.73**		**$3,385.47**	**0.0%**
16	41I Firm Sales	Block 1	331,379	2,000	3,670.0	$250.00	$622.72	($372.72)	$622.72	($372.72)	$0.94622		$0.94622		
17		Block 2	593,487	all additional							$0.89909		$0.89909		
18		**TOTAL**										**$3,021.20**		**$3,021.20**	**0.0%**
19	41C Interr Sales	Block 1	0	2,000	0.0	$250.00	$515.09	$250.00	$515.09	$250.00	$0.96427		$0.96546		
20		Block 2	0	all additional							$0.91047		$0.91150		
21		**TOTAL**										**$250.00**		**$250.00**	**0.0%**
22	41I Interr Sales	Block 1	0	2,000	0.0	$250.00	$622.72	$250.00	$622.72	$250.00	$0.90245		$0.90245		
23		Block 2	0	all additional							$0.85609		$0.85609		
24		**TOTAL**										**$250.00**		**$250.00**	**0.0%**
25	41C Firm Trans	Block 1	123,243	2,000	4,251.0	$500.00	$515.09	($15.09)	$515.09	($15.09)	$0.64044		$0.64044		
26		Block 2	284,875	all additional							$0.59302		$0.59302		
27		**TOTAL**										**$2,600.68**		**$2,600.68**	**0.0%**
28	41I Firm Trans	Block 1	0	2,000	0.0	$500.00	$622.72	$500.00	$622.72	$500.00	$0.62856		$0.62856		
29		Block 2	0	all additional							$0.58256		$0.58256		
30		**TOTAL**										**$500.00**		**$500.00**	**0.0%**
31	42C Firm Sales	Block 1	820,213	10,000	22,449.0	$1,300.00	$5,142.27	($3,842.27)	$5,142.27	($3,842.27)	$0.79626		$0.79622		
32		Block 2	926,223	20,000							$0.77027		$0.77023		
33		Block 3	323,675	20,000							$0.71863		$0.71860		
34		Block 4	84,983	100,000							$0.68461		$0.68459		
35		Block 5	0	600,000							$0.63927		$0.63925		
36		Block 6	0	all additional							$0.58259		$0.58259		
37		**TOTAL**										**$13,709.42**		**$13,708.52**	**0.0%**
38	42I Firm Sales	Block 1	887,030	10,000	11,726.0	$1,300.00	$3,945.77	($1,522.80)	$3,945.77	($1,522.80)	$0.73169		$0.73169		
39		Block 2	668,287	20,000							$0.71258		$0.71258		
40		Block 3	109,048	20,000							$0.67457		$0.67457		
41		Block 4	24,233	100,000							$0.64957		$0.64957		
42		Block 5	0	600,000							$0.61626		$0.61626		
43		Block 6	0	all additional							$0.57455		$0.57455		
44		**TOTAL**										**$7,024.01**		**$7,024.01**	**0.0%**
45	42C Firm Trans	Block 1	122,544	10,000	84,672.0	$1,550.00	$5,142.27	($3,592.27)	$5,142.27	($3,592.27)	$0.40332		$0.40332		
46		Block 2	245,088	20,000							$0.38640		$0.38640		
47		Block 3	245,088	20,000							$0.35269		$0.35269		
48		Block 4	403,344	100,000							$0.33054		$0.33054		
49		Block 5	0	600,000							$0.30097		$0.30097		
50		Block 6	0	all additional							$0.26403		$0.26403		
51		**TOTAL**										**$26,683.21**		**$26,683.21**	**0.0%**
52	42I Firm Trans	Block 1	933,452	10,000	60,372.0	$1,550.00	$3,945.77	($2,395.77)	$3,945.77	($2,395.77)	$0.40096		$0.40096		
53		Block 2	1,354,332	20,000							$0.38427		$0.38427		
54		Block 3	1,182,765	20,000							$0.35105		$0.35105		
55		Block 4	2,743,941	100,000							$0.32922		$0.32922		
56		Block 5	1,030,134	600,000							$0.30009		$0.30009		
57		Block 6	0	all additional							$0.26369		$0.26369		
58		**TOTAL**										**$19,734.90**		**$19,734.90**	**0.0%**
59	42C Interr Sales	Block 1	237,824	10,000	39,550.0	$1,300.00	$5,142.27	($3,842.27)	$5,142.27	($3,842.27)	$0.71133		$0.71192		
60		Block 2	449,890	20,000							$0.69043		$0.69095		
61		Block 3	201,897	20,000							$0.64878		$0.64917		
62		Block 4	59,596	100,000							$0.62141		$0.62174		
63		Block 5	0	600,000							$0.58493		$0.58514		
64		Block 6	0	all additional							$0.53925		$0.53934		
65		**TOTAL**										**$23,275.48**		**$23,295.50**	**0.1%**
66	42I Interr Sales	Block 1	171,533	10,000	16,547.0	$1,300.00	$3,945.77	($2,645.77)	$3,945.77	($2,645.77)	$0.69064		$0.69064		
67		Block 2	27,036	20,000							$0.67199		$0.67199		
68		Block 3	0	20,000							$0.63489		$0.63489		
69		Block 4	0	100,000							$0.61048		$0.61048		
70		Block 5	0	600,000							$0.57791		$0.57791		
71		Block 6	0	all additional							$0.53724		$0.53724		
72		**TOTAL**										**$8,660.15**		**$8,660.15**	**0.0%**
73	42C Inter Trans	Block 1	0	10,000	0.0	$1,550.00	$5,142.27	$1,550.00	$5,142.27	$1,550.00	$0.39076		$0.39076		
74		Block 2	0	20,000							$0.37516		$0.37516		
75		Block 3	0	20,000							$0.34405		$0.34405		
76		Block 4	0	100,000							$0.32360		$0.32360		
77		Block 5	0	600,000							$0.29633		$0.29633		
78		Block 6	0	all additional							$0.26221		$0.26221		
79		**TOTAL**										**$1,550.00**		**$1,550.00**	**0.0%**
80	42I Inter Trans	Block 1	952,237	10,000	84,098.0	$1,550.00	$3,945.77	($2,395.77)	$3,945.77	($2,395.77)	$0.39347		$0.39347		
81		Block 2	1,827,775	20,000							$0.37758		$0.37758		
82		Block 3	1,364,376	20,000							$0.34592		$0.34592		
83		Block 4	4,116,253	100,000							$0.32511		$0.32511		
84		Block 5	1,831,129	600,000							$0.29736		$0.29736		
85		Block 6	0	all additional							$0.26266		$0.26266		
86		**TOTAL**										**$27,094.53**		**$27,094.53**	**0.0%**
87	43 Firm Trans		0	N/A	0.0	$38,000.00		$38,000.00	0.0		$0.24685	$38,000.00	$0.24685	$38,000.00	0.0%
88	43 Interr Trans		0	N/A	0.0	$38,000.00		$38,000.00	0.0		$0.24685	$38,000.00	$0.24685	$38,000.00	0.0%
89	Intentionally blank														

90 **[1] Rate Schedule 41 and 42 customers may choose demand charges at a volumetric rate or based on MDDV. For convenience of presentation, demand charges are not included in the calculations for those**
91 **schedules.**
92 **[2] Proposed new CCA rates is equal to Current Billing Rate plus New CCA rates less current CCA rates. Assumes customer receives CCA credit.**
93
94
95 **[3] For Schedules where the average usage would generate a new credit, the non-volumetric credits have been capped at the CCA cost.**
96 **Sources:** 4.1%

97	Direct Inputs	per Tariff per Tariff
98		
99	Rates in summary	Column A

NW Natural
Rates & Regulatory Affairs
2025-2026 PGA Filing - Washington: September Filing
Summary of Deferred Accounts

	Account	Balance 8/31/2025	Sep-Oct Estimated Activity	Sep-Oct Interest	Estimated Balance 10/31/2024	Estimated Interest During Amortization	Total Estimated Amount for (Refund) or Collection	Amounts Excluded from PGA Filing	Amounts Included in PGA Filing
	A	B	C	D	E	F	G	H	I
					E = sum B thru D	**7.50%**	G = E + F		
1							Excl. Rev Sens		
2	**DSM & LOW INCOME PROGRAMS**								
10									
11	151894 WA DSM AMORTIZATION	59,658	(17,439)	623	42,843				
12	151898 WA ENERGY EFFICIENCY	108,574	(213,924)	-	(105,350)				
13		168,232	(231,363)	623	(62,508)	(2,568)	(65,076)		(65,076)

Company:	Northwest Natural Gas Company
State:	Washington
Description:	Washington EE Amortization
Account Number:	151894
	Program under Schedule G
	Temp Increment under Schedule 215
	UG-181053

Debit (Credit)

Month/Year	Note	Amortization	Transfers	Interest Rate	Interest	Activity	Balance
(a)	(b)	(c)	(d)	(e1)	(e2)	(f)	(g)
Nov-24	*NEW*	(10,605.59)	147,887.13	8.50%	1,009.97	138,291.51	343,202.01
Dec-24		(52,424.12)		8.50%	2,245.35	(50,178.77)	293,023.24
Jan-25		(56,377.64)		8.04%	1,774.39	(54,603.25)	238,419.99
Feb-25		(62,503.46)		8.04%	1,388.03	(61,115.43)	177,304.56
Mar-25		(42,711.94)		8.04%	1,044.86	(41,667.08)	135,637.48
Apr-25		(29,200.89)		7.55%	761.52	(28,439.37)	107,198.11
May-25		(17,656.31)		7.55%	618.91	(17,037.40)	90,160.71
Jun-25		(13,159.50)		7.55%	525.86	(12,633.64)	77,527.07
Jul-25		(10,223.47)		7.50%	452.60	(9,770.87)	67,756.20
Aug-25		(8,494.92)		7.50%	396.93	(8,097.99)	59,658.21
Sep-25	*Forecasted*	*(11,175.61)*		7.50%	337.94	(10,837.67)	48,820.54
Oct-25	*Forecasted*	*(6,263.58)*		7.50%	285.55	(5,978.03)	42,842.51

History truncated for ease of viewing

Notes

1 - Transfer in amounts from accounts 186310 and 186312 approved for amortization.

Company: Northwest Natural Gas Company
State: Washington
Description: Washington EE True-Up Deferral
Account Number: 151898
Program under Schedules G
Temp Increment under Schedule 215

Month/Year	Note	Deferral	Transfers	Activity	Balance
(a)	(b)	(c)	(d)	(g)	(h)
Beginning Balance					
Nov-23	NEW	(464,484.58)	(227,776.96)	(692,261.54)	988,115.95
Dec-23		(556,924.55)		(556,924.55)	431,191.40
Jan-24		(477,352.77)		(477,352.77)	(46,161.37)
Feb-24		637,505.97		637,505.97	591,344.60
Mar-24		(437,310.92)		(437,310.92)	154,033.67
Apr-24		(259,180.99)		(259,180.99)	(105,147.32)
May-24		(197,218.57)		(197,218.57)	(302,365.89)
Jun-24		(91,656.81)		(91,656.81)	(394,022.70)
Jul-24		1,055,318.64		1,055,318.64	661,295.94
Aug-24		(98,052.62)		(98,052.62)	563,243.32
Sep-24		(109,482.63)		(109,482.63)	453,760.69
Oct-24		923,502.85		923,502.85	1,377,263.54
Nov-24	*OLD*	357.97		357.97	1,377,621.50
Nov-24	*NEW*	(445,689.26)	(147,887.13)	(593,576.39)	784,045.11
Dec-24		(648,097.40)		(648,097.40)	135,947.72
Jan-25		(532,004.28)		(532,004.28)	(396,056.57)
Feb-25		(548,002.11)		(548,002.11)	(944,058.68)
Mar-25		590,129.79		590,129.79	(353,928.90)
Apr-25		(197,933.05)		(197,933.05)	(551,861.94)
May-25		(83,523.63)		(83,523.63)	(635,385.57)
Jun-25		(39,816.02)		(39,816.02)	(675,201.59)
Jul-25		871,858.47		871,858.47	196,656.88
Aug-25		(88,082.88)		(88,082.88)	108,574.00
Sep-25	*Forecasted*	*(137,088.38)*		(137,088.38)	(28,514.38)
Oct-25	*Forecasted*	*(76,835.92)*		(76,835.92)	(105,350.30)

History truncated for ease of viewing

NW Natural
Rates & Regulatory Affairs
2025-26 Washington: September Filing
Tariff Advice 25-04: Schedule 215 Effects on Revenue

		Amount
	Temporary Increments	
	Removal of Current Temporary Increments	
	Amortization of Energy Efficiency Programs	(5,308,861)
	Addition of Proposed Temporary Increments	
	Amortization of Energy Efficiency Programs	5,425,850
	TOTAL OF ALL COMPONENTS OF RATE CHANGES	**$116,989**
	2024 Washington CBR Normalized Total Revenues	**$109,949,935**
	Effect of this filing, as a percentage change	**0.11%**

NW Natural®

Washington 2024
Annual Energy Efficiency Report
June 15, 2025

Table of Contents

Executive Summary

NW Natural is pleased to present this 2024 Washington Annual Energy Efficiency Report. While existing programs faced challenges with participation uptake in 2024, new pilot programs were able to mitigate savings shortfalls. As a result, NW Natural achieved 122% of the annual goal and 61% of the biennial conservation target. Several custom commercial projects that were anticipated to close in 2024 will finish in 2025 keeping the Company well positioned to meet both the biennial target and biennial program goals set forth in the 2024-2025 Biennial Energy Efficiency Plan. As the 2025 program year progresses, NW Natural will continue to monitor the savings forecasts to ensure the Company remains on track to hit the conservation target.

Table 1 - 2024-25 Biennial EE Plan Summary

2024-2025 EE Plan Summary		Biennial Therms Goal	Biennial Cost
Incentive Programs	Commercial	286,592	$ 2,862,137
	Residential	229,062	$ 4,293,345
Low-Income	WA-LIEE	8,680	$ 283,885
Market Transformation*	NEEA	60,000	$ 329,353
Pilots & Trial Programs	Behavioral	205,708	$ 753,756
	Industrial	TBD	$ 150,000
Regional Planning	RTF	N/A	$ 26,100
Conservation Potential Assessment	CPA	N/A	$ 150,000
Program Validation	Evaluation	N/A	$ 160,000
Biennial Savings Goal**			790,042
EE Plan Total			$ 9,008,576
CPA 2-year Target			720,000

*Market Transformation savings are estimates based on NEEA's savings projection range. There is a high degree of uncertainty with savings projection.
**Biennial Savings Goal has been updated from the 2024-25 Biennial Energy Efficiency Plan due to a calculation error. The CPA 2-year acquisition target remains the same.

Table 2 - 2024 Savings Summary (therms)

Category	Program	2024 Goal	2024 Actuals	Percent of Goal
Incentive Programs	Commercial	133,179	121,183	91%
	Residential	111,060	95,578	86%
Low-Income	WA-LIEE	3,255	712	22%
Market Transformation*	NEEA	20,000	26,010	130%
Pilots & Trial Programs	Behavioral	93,024	197,373	212%
Total		360,518	440,856	122%

Table 3 - 2024 Expenditure Summary

Category	Program	2024 Budget	2024 Expenditure	Percent of Budget
Incentive Programs	Commercial	$ 1,346,925	$ 1,231,449	91%
	Residential	$ 2,117,068	$ 1,547,330	73%
Low-Income	WA-LIEE	$ 109,722	$ 42,725	39%
Market Transformation*	NEEA	$ 88,149	$ 88,148	100%
Pilots & Trial Programs	Behavioral	$ 460,669	$ 324,899	71%
	Industrial	$ 150,000	$ 20,959	14%
Regional Planning	RTF	$ 11,100	$ 11,100	100%
Conservation Potential Assessment	CPA	$ -	$ -	-
Program Validation	Evaluation	$ 60,000	$ 8,300	14%
	Total	$ 4,343,633	$ 3,274,909	75%

Table 4 - 2024 Benefit Cost Ratios

Program	Utility Cost Test Benefit/Cost Ratio	Total Resource Cost Test Benefit/Cost Ratio
Commercial Programs	2.31	1.75
Residential Programs	2.54	1.68
Total NW Natural Washington Energy Trust Programs*	2.44	1.71
NW Natural Low Income Program (only)	0.77	0.67
NW Natural Behavioral Program Pilot	1.66	1.66
Total NW Natural Washington Programs	*2.34*	*1.69*
*Total Washington Portfolio***	*2.73*	*1.99*

** does not include NEEA or WA_LIEE expenses or Pilots*

*** includes costs associated with NEEA's gas market transformation efforts.*

Background

Programs

NW Natural has been offering energy efficiency programs in SW Washington in partnership with the Energy Trust of Oregon (Energy Trust) for the past 15 years. Energy Trust serves both residential and commercial customers and has several pathways for engagement and incentives. For the residential sector, there are rebates for heating, domestic hot water, and envelop efficiency measures. Historically, Energy Trust has worked with builders to offer incentives for going beyond code requirements. However, due to recent building code changes the new homes program will be winding down. For the commercial sector there are both standard rebates for projects that have deemed savings and a custom pathway for more complex projects. Commercial customers may also participate in Strategic Energy Management (SEM) which puts customers in a cohort with other participating buildings and helps them track their energy use and identify non-capital improvements. In addition to the Energy Trust incentive programs, NW Natural also provides low-income programs, market transformation, and pilot programs.

The Company works with Community Agencies to provide free weatherization services through the Washington Low-Income Energy Efficiency (WA-LIEE) program. Customers who fall under the 80% Area Median Income (AMI) threshold are eligible for WA-LIEE.

For market transformation, NW Natural participates in the Northwest Energy Efficiency Alliance (NEEA). NEEA is an alliance of utilities and energy efficiency organizations that work with the market to advance energy-efficient technologies.

The Industrial Audit Pilot ran from Fall 2022-2024. The purpose of the pilot was to conduct high level energy efficiency audits at industrial sites to gauge the interest and types of programming that would be most helpful for this customer class.

The Behavioral Energy Efficiency (BEE) Pilot is a three-year home energy report style program that encourages residential customers to save energy through behavioral changes. Participants receive monthly communications with tips, similar home comparisons, and information on available energy efficiency programs. The program launched in late 2023 and 2024 is the first year of reported energy savings.

In conjunction with the savings programs, NW Natural also funds the Northwest Power and Conservation Council's (NWPCC) Regional Technical Forum (RTF). The RTF is a regional resource that develops unit energy savings for different measures that are used to inform our programs.

Reporting

In accordance with Washington Utilities and Transportation Commission's reporting requirements, NW Natural submits a Biennial Energy Efficiency Plan every other year and files either an annual or biennial report in June every year following the completion of the program years. 2024 marks the first year of the two-year reporting cycle.

Goals for the 2024-25 biennium are based on the 2023 Conservation Potential Assessment (CPA). CPAs are conducted every other year by a third party and used by the Company for both energy efficiency program planning and integrated resource planning.

Program Results

Energy Trust Annual Report

The content of this section has been prepared by the Energy Trust of Oregon.

Highlights

General

- In 2024, Energy Trust achieved 89% of the annual portfolio goal.
- Gas efficiency projects installed in 2024 by NW Natural's Washington customers saved 216,761 annual therms of natural gas—121,183 therms in the commercial sector and 95,578 therms in the residential sector.

Commercial sector highlights

- The commercial sector achieved 91% of its annual goal.

- The program fell short of goal due to three large prescriptive school projects (totaling 9,345 therms) that were delayed until 2025.
- There was an uptick in custom operations and maintenance projects that generated more savings in 2024 compared with previous years.
- Strategic Energy Management (SEM) savings finished at 128% of the goal. There were eight SEM participants in the program year running from April 2024 to April 2025.
- Prescriptive projects included grocery stores, schools, churches, laundry facilities and large retailers.
- Wal-Mart and Vancouver High School were the two largest custom projects in 2024 for a total of 23,540 therms.
- The program shifted its outreach approach to diversify the team and more effectively serve the commercial market. This included having an energy advisor focused on large accounts outside colleges and universities, K-12 schools, healthcare and hospitals, multifamily, and small businesses. (Each of those have a dedicated energy advisor.)
- The program team advanced the Language Accessibility Pathway and tailored efforts to better serve priority populations while also extending outreach to smaller businesses in outlying areas for SEM recruitment.

Residential sector highlights

- The residential sector achieved 86% of its annual goal.
- Approximately 98% of residential savings were delivered by home retrofit upgrades, while 2% came from EPS New Construction. This was the final year for New Construction incentives because of advances in Washington's residential building code.
- The largest driver of savings were gas furnaces, smart thermostats and insulation. Savings from attic insulation alone doubled from 2023 to 2024 as a result of promotions and outreach.
- Income-qualified incentives for gas furnaces introduced in quarter three gained traction in quarter four with 18 Savings Within Reach furnace projects submitted. These projects helped make up for lower-than-expected gas furnace savings overall caused by a decline in the market rate single family installations.
- Savings from window projects fell significantly in 2024 compared to previous years after one large contractor announced it would cease project submissions in early 2024. This trade ally, who consistently submitted a high volume of windows projects year-over-year, abruptly ceased incentive and rebate program involvement, citing operating costs associated with project submissions. This decision contributed significantly to the residential program's inability to reach 2024 savings goals.

Trade Ally Network highlights

- At the end of 2024, 463 trade allies served Washington, up from 416 in 2023. This includes 185 trade allies based in Washington.

Washington Utilities and Transportation Commission performance metrics

The tables below compare quarterly results to 2024 goals as established in NW Natural's Energy Efficiency Plan for Washington.

Table 5 - 2024 Results Compared to Goals

Metric	Goal	Annual	Q1 results	Q2 results	Q3 results	Q4 results
Therms Saved	244,239	216,761	72,662	35,770	55,802	52,527
Total Program Expenditures	$ 3,464,008	$ 2,778,779	$ 631,001	$ 623,233	$ 851,456	$ 673,090
Average Levelized Cost Per Therm	Less than $0.90	$ 1.06	$ 1.07	$ 1.16	$ 1.12	$ 0.98
Utility Cost at Portfolio Level	Greater than 1.00	$ 2.44	Reported annually	Reported annually	Reported annually	Reported annually

* *does not include NEEA or WA_LIEE expenses*

Table 6 - 2023 Results Compared to Goals (For Reference)

Metric	Goal	Annual	Q1 results	Q2 results	Q3 results	Q4 results
Therms Saved	281,908	272,936	48,300	24,423	85,961	114,253
Total Program Expenditures	$ 3,253,106	$ 2,972,269	$ 722,326	$ 600,463	$ 693,056	$ 956,425
Average Levelized Cost Per Therm	Less than $0.90	$ 0.85	$ 1.18	$ 1.57	$ 0.64	$ 0.68
Utility Cost of Energy Trust Programs*	Greater than 1.00	$ 2.79	Reported annually	Reported annually	Reported annually	Reported annually

Annual Results

Table 7 - Energy Trust Commercial Sites Served

	Q1	Q2	Q3	Q4	Total
Commercial					
Appliance	-	-	-	3	3
Food Service	-	-	-	1	1
HVAC	1	4	2	4	10
HVAC controls	1	-	-	-	1
Operations & Maintenance	9	-	-	2	10
Process cooling	-	-	-	-	-
Process heating	-	-	1	-	1
Refrigeration	-	-	1	-	1
Study	1	-	1	2	4
Water heating	-	3	-	2	5
Weatherization	-	-	-	-	-

Table 8 - Energy Trust Residential Sites Served

	Q1	Q2	Q3	Q4	Total
Residential					
EPS new construction	-	2	30	-	32
New manufactured homes	-	-	-	-	-
HVAC	120	124	139	177	560
HVAC Controls	59	120	129	207	515
Water Heating	4	6	5	11	26
Weatherization	27	61	34	52	174

Table 9 - Energy Trust 2024 Revenue

Source	Annual actual revenue	Annual budgeted revenue
NW Natural	$ 3,433,935	$ 3,433,935

Table 10 - Energy Trust 2024 Program Expenditures

		Annual actual expenditures	Annual budgeted expenditures	Budget variance
Commercial	Commercial	$ 1,166,363	$ 1,271,215	$ -104,852
	Commercial administration	$ 65,086	$ 75,717	$ -10,631
	Commercial Total	**$ 1,231,449**	**$ 1,346,932**	**$ -115,483**
Residential	Residential	$ 1,465,187	$ 1,998,065	$ -532,878
	Residential administration	$ 82,143	$ 119,011	$ -36,868
	Residential Total	**$ 1,547,330**	**$ 2,117,076**	**$ -569,746**
	Total expenditures	**$ 2,778,779**	**$ 3,464,008**	**$ -685,228**

Table 11 - Energy Trust 2024 Incentives Paid

	Annual actual incentives	Annual actual expenditures	Percent incentives/ expenditures
Commercial	$ 444,456	$ 1,231,449	36%
Residential	$ 787,975	$ 1,547,330	51%
Total Incentives	**$ 1,232,431**	**$ 2,778,779**	44%

Incentives paid account for approximately 52% of annual program expenses when total program expenses are adjusted down by 15% to account for costs that a utility-delivered program would recover through rates.

Table 12 - Energy Trust 2024 Annual Savings

		Annual savings therms	Annual goal therms	Percent achieved	Levelized cost/therm
Commercial	Existing Buildings - custom	23,735	46,500	51%	
	Existing Buildings - standard	35,388	37,260	95%	
	New Buildings - custom	-	-	N/A	
	New Buildings - standard	6,188	5,640	110%	
	Strategic Energy Management	55,873	43,779	128%	
	Commercial total	**121,183**	**133,179**	**91%**	**$ 1.20**
Residential	Home retrofit	91,069	105,088	87%	
	Midstream and retail	-	151	-	
	New manufactured homes	-	-	N/A	
	Small multifamily	2,824	2,496	113%	
	EPS new construction	1,685	3,325	51%	
	Residential total	**95,578**	**111,060**	**86%**	**$ 1.02**
	Total	**216,761**	**244,239**	**89%**	**$ 1.06**

Table 13 - Energy Trust Residential Sector Measures

Category	Measure	Measures installed	Total therms saved
New construction	Energy performance score	64	1,685
	New contruction total	**64**	**1,685**
New manufactured homes	-	-	-
	New manufacture homes total	**-**	**-**
HVAC	Furnace	536	59,432
	Gas fireplace	33	720
	HVAC total	**569**	**60,151**
HVAC controls	Thermostat	516	16,461
	Thermostat optimization	7	2,576
	HVAC controls total	**523**	**19,037**
Water heating	Tanked water heater	-	-
	Tankless water heating	26	1,578
	Water heating total	**26**	**1,578**
Weatherization	Ceiling insulation	52	7,271
	Floor insulation	21	2,360
	Wall insulation	12	458
	Windows	137	3,036
	Weatherization total	**222**	**13,126**
Grand total		**1,404**	**95,578**

Table 14 - Energy Trust Commercial Sector Measures

Category	Measure	Measures installed	Total therms saved
Appliance	Clothes dryer	3	2,838
	Appliance total	**3**	**2,838**
Foodservice	Fryer	-	-
	Oven	1	616
	Foodservice total	**1**	**616**
HVAC	Boiler	9	9,089
	Building controls	2	11,653
	Variable air volumn	-	-
	Demand control ventilation	4	1,386
	Gas furnace	2	151
	Radiant heating	10	3,167
	HVAC total	**27**	**25,447**
HVAC controls	Thermostat	1	432
	HVAC controls total	**1**	**432**
Operations & maintenance	Building operator certification	4	6,301
	Custom operations & maintenance	9	55,873
	Operations & maintenance total	**13**	**62,174**
Process heating	Custom heat recovery	1	12,082
	Process heating total	**1**	**12,082**
Refrigeration	Refrigeration	1	15,128
	Refrigeration total	**1**	**15,128**
Study	Study	4	-
	Study total	**4**	**-**
Water heating	Aerator	-	-
	Tanked water heater	11	2,467
	Tankless water heating	-	-
	Water heating total	**11**	**2,467**
Weatherization	Ceiling insulation	-	-
	Wall insulation	-	-
	Weatherization total	**-**	-
Grand total		**62**	**121,183**

Customer Satisfaction

Energy Trust conducted short web and phone surveys of NW Natural customers in Washington who participated in Energy Trust programs in 2024 to determine their satisfaction with Energy Trust. Results from 173 residential customers indicate a generally high level of customer satisfaction. Most residential customers were satisfied with their overall program experience, but some were neutral or dissatisfied with the turnaround time to receive their incentive and the incentive application form.

Table 15 - Residential Customer Satisfaction 2024

Residential (n=173)	Dissatisfied	Neutral	Satisfied
Overall experience	3%	6%	91%
Incentive application form	5%	11%	85%
Turnaround time to receive incentive	12%	16%	72%

Only three commercial customers in Washington who participated in Energy Trust programs in 2024 were surveyed. (Strategic Energy Management participants are not eligible for this survey.) All three were satisfied with their overall program experience, incentive amount, ease of applying for the incentive, interaction with program representatives, performance of their project or system and turnaround time to receive the incentive.

Table 16 - Commercial Satisfaction

Commercial (n=3)	Dissatisfied	Neutral	Satisfied
Overall experience	0%	0%	100%
Incentive amount	0%	0%	100%
Ease of applying for incentive	0%	0%	100%
Interaction with program representative	0%	0%	100%
Performance of project or system	0%	0%	100%
Turnaround time to receive incentive	0%	0%	100%

Washington Low-Income Energy Efficiency (WA-LIEE)

The primary goal of the low-income program is to serve underserved markets and customers who are unable to access to traditional energy efficiency incentive programs. For whole-home weatherization efforts, WA-LIEE partners leverage funding from state, federal, and local agencies. These leveraged funds are subject to savings to investment ratio tests or must comply with approved measures lists.

In 2024, NW Natural set a goal of completing 6 projects with an estimated total energy savings of 3,255 therms. Our partners exceeded the project target, completing 12 projects. However, actual therm savings were lower than projected, largely due to the types of measures installed, primarily furnace replacements and tune-ups. It is important to note that these homes received additional comprehensive weatherization measures funded by other programs. As a result, these savings are not included in savings calculations. NW Natural is observing a similar trend in 2025.

Table 17 – WALIEE Completions

2024 Performance Metric	Goal	Actual
Homes served	6	12
Max reimbursement per home (Actual figure = avg per home)	$8,933	$3,560
Average estimated therms saved per home	325	59
Total estimated therms saved	8,138	712
Total expenditure	$100,720	$42,725

Looking ahead, NW Natural anticipates a new partnership with Northwest Community Action Center, the current service provider for South Yakima Valley (NCAC). NCAC will begin serving customers in Skamania and Klickitat counties. NW Natural expects this collaboration to improve program access and outcomes in these historically underserved areas.

At the same time, NW Natural will increase its outreach efforts across Clark, Skamania, and Klickitat counties in 2025. These efforts aim to raise awareness of programs available to income-qualified customers, including the Bill Discount Program and GREAT. Outreach events will include the distribution of informational pamphlets and do-it-yourself weatherization kits to help connect residents with available resources.

In addition, NW Natural is looking to implement improvements informed by the recent program and impact evaluation, which identified opportunities to strengthen documentation practices for weatherization projects. Improving the quality and consistency of collected data will support improved program oversight and reporting.

Northwest Energy Efficiency Alliance

In 2024, NW Natural continued its partnership with NEEA. NEEA is a regional organization that pools utility resources to advance market transformation in the northwest. Annual gas savings are expected to increase over time as the programs within NEEA's portfolio advance into full-scale market development. The 2024 reportable savings are primarily driven by NEEA's work in

advancing Washington State Energy Code with some additional savings attributable to their product standard work and commercial efficient rooftop units.

Table 18 - NEEA 2024 Summary

	Goal	Actual	Percent of Goal
NEEA Budget	$ 88,149.00	$ 88,148.23	100%
Savings (therms)	20,000	26,010	130%

Table 19 - 2024 NEEA Savings by Initiative

Sector	Initiative		2024 Savings (therms)
Commercial			2,333
	Efficient Rooftop Units		21
		Total Heating Season COP >= 0.65	21
		Total Heating Season COP >= 0.80	-
	Product Standards		777
		Fryers OR State Standard	-
		Fryers WA State Standard	532
		Steam Cookers OR State Standard	-
		Steam Cookers WA State Standard	246
		Consumer Gas Furnaces	-
	New Construction (Code Development)		1,535
		ID (NEEA Territory)	-
		OR	-
		WA	1,535
Residential			23,677
	Product Standards		-
		Consumer Gas Furnaces	-
	New Construction (Code Development)		23,677
		ID (NEEA Territory)	-
		OR	-
		WA	23,677
		Next Step Homes	-
Total			26,010

Regional Gas Portfolio Update

Efficient Rooftop Units (ERTUs)

In 2024, NEEA updated the program's efficiency rooftop units measure specification to align with a fuel-neutral approach. This focuses the program on the rooftop unit cabinet design and shell measures which include cabinet insulation, low-leakage dampers, and heating/energy recovery. Other notable work included working with a manufacturer to design and bring an energy recovery ventilator product to market and completing a performance monitoring study for two units installed in Portland.

Advanced Commercial Water Heating NEEA's Commercial Water Heating program is focused on utilizing gas heat pumps for commercial central water heating applications. Work done in 2024 included completing a market research study to gauge interest on the product.

High-Efficiency Dedicated Outdoor Air Systems

In 2024, NEEA started a plan to add a gas option to the Dedicated Outdoor Air program that had been developed under the electric portfolio. This inclusion is anticipated to provide more impactful market transformation opportunities across both fuel types.

Residential HVAC & Water Heaters

NEEA has been exploring residential dual fuel HVAC systems which would pair a heat pump with a gas appliance to deliver an efficient combined HVAC system. NEEA has convened regional stakeholders and partners on lab and field-testing projects.

Due to policy directives in Washington, NEEA is winding down activities related to their efficient residential gas water heating program. NEEA will continue to engage with the North American Gas Heat Pump Collaborative and monitor product progress for inclusion in future building codes or product standards.

NEEA Savings Methodology

NEEA allocates code savings for gas measures using a state and service territory approach. For residential codes, NEEA estimates the number of code-compliant new homes and applies a savings rate based on the Regional Technical Forum's SEEM model and new constructure square footage to estimate savings by state. NEEA then allocates these savings to funders based on the utility's shared of the state residential energy sales from the Energy Information Administration (EIA). This allocation approach was also used for Efficient Rooftop Unit savings because the program is new to the market.

Table 20 - NEEA State Code Allocation Share for NW Natural

Sector	WA	OR	ID
Residential	6.62%	0%	0%
Commercial	4.15%	0%	0%

Pilot and Trial Programs

Behavioral Energy Efficiency

NW Natural launched the Behavioral Energy Efficiency Pilot in Q4 of 2023. 2024 marks the first full year of the program and the first year with reportable savings. Participants receive monthly email communications about their energy use along with four paper reports that are sent throughout the year. In 2024, the pilot exceeded the savings target set forth in the biennial plan. This is largely attributed to having a ramp up period before the 2024 program year and additional cost pressures that may have further encouraged customers to act on the tips to save energy. Overall program spend was less than budgeted for 2024 as some of the platform fees were incurred in 2023.

Table 21 - BEE Pilot 2024 Results

BEE Program	2024 Budget/Goal	2024 Actual	Percent of Budget/Goal
Platform Cost	$250,000	$100,000	40%
Treatment Cost	$123,840	$130,244	105%
Paper Report Cost	$86,829	$94,654	109%
Program Budget	$460,669	$324,898	71%
Program Savings Goal (therms)	93,024	197,373	212%

46,202 customers were included in the participation group at the start of 2024 and the program ended the year with 43,257 participants. This attrition rate is average for this type of program and largely driven by move-outs.

NW Natural receives data on email messaging and feedback obtained from the online platform. Overall reception of the program has been positive. Negative reviews have been around the inaccuracy of data, use of personal information, and directives to use less energy. The top positive feedback responses have been in favor of the monthly usage trends, energy saving tips, and the breakdown of usage by appliance.

Table 22 - BEE Pilot Online Feedback

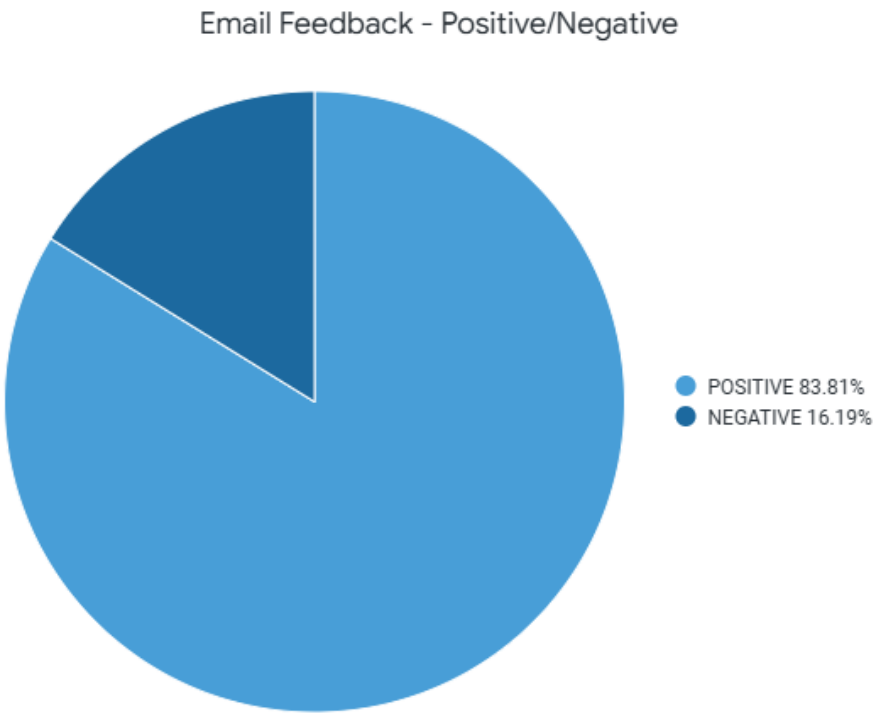
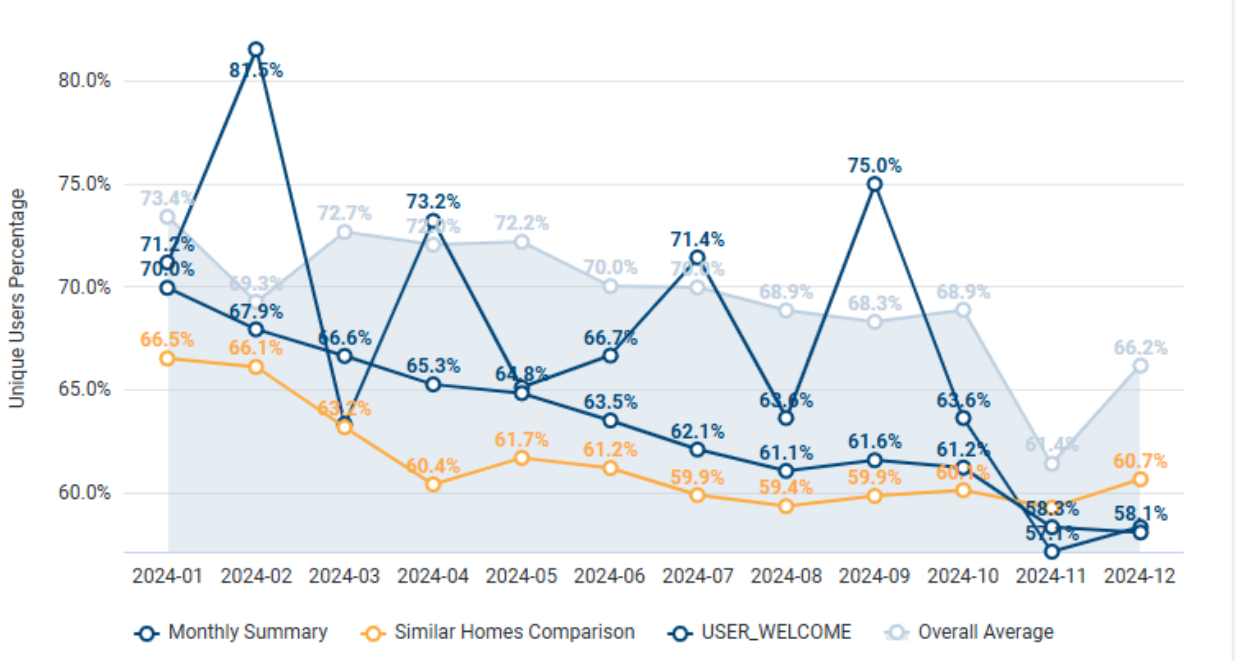


Table 23 - BEE Program Email Open Rates



Industrial Audit Pilot

In 2024, NW Natural wrapped up the Industrial Audit Pilot. Two additional sites received high-level energy efficiency audits. Each audit involved a site visit by a certified energy auditor that collected information about the equipment operations and efficiency level. A site-specific report was developed for each participating site that identified opportunities for efficiency and decarbonization with estimated costs and savings. In the Fall of 2024, a final report summarizing all 6 site visits was shared with the EEAG.

While the pilot did not see a large uptake, it did demonstrate that there was interest and sizable opportunity for energy efficiency at these industrial sites. Understanding the types of measures and magnitude of savings is NW Natural's first step in developing an incentive program. Since no projects were incentivized through this program there are no savings claimed through this pilot.

Evaluations

In 2024, NW Natural hired Evergreen Economics to conduct a portfolio level savings verification for the 2022-23 Biennial Energy Efficiency Report. That was the only evaluation expense incurred in the 2024 program year.

Table 24 - Evaluation Expenditures

Evaluations	2024 Budget	2024 Actual	Percent of Budget
Total	60,000	8,300	14%

In 2025, two evaluations were conducted to evaluate and verify savings of NW Natural programs. The Behavioral Energy Efficiency Pilot and the Washington Low-Income Energy Efficiency Program both received evaluations conducted by ADM Associates. The reports were shared with the EEAG and are included in the Appendices.

Appendices

Appendix A: Acronym List

Abbreviation	Definition
AEER	Annual Energy Efficiency Report
AEG	Applied Energy Group
AFUE	Annual Fuel Utilization Efficiency
AMI	Area Median Income
BEE	Behavioral Energy Efficiency
BEEP	Biennial Energy Efficiency Plan
BEER	Biennial Energy Efficiency Report
BOC	Building Operator Certification
CAC	Conservation Advisory Council
CDFI	Community Development Financial Institution
CPA	Conservation Potential Assessment
DAC	Diversity Advisory Council
DHW	Domestic Hot Water
DOE	Department of Energy
DSM	Demand-Side Management
EEAG	Energy Efficiency Advisory Group
EPS	Trademarked name used for residential new homes program
ETO	Energy Trust of Oregon
EUI	Energy Usage Index
FPL	Federal Poverty Level
HER	Home Energy Report
HVAC	Heating Ventilation and Air Conditioning
IOU	Investor-Owned Utility
IRP	Integrated Resource Plan
NEB	Non-Energy Benefit
NEEA	Northwest Energy Efficiency Alliance
NWPCC	Northwest Power and Conservation Council
O&M	Operations and Maintenance
PUD	Public Utility District
RTF	Regional Technical Forum
SEM	Strategic Energy Management
SMI	State Median Income
TRC	Total Resource Cost
UCT	Utility Cost Test
WAC	Washington Administrative Code
WA-LIEE	Washington Low-Income Energy Efficiency
WSEC	Washington State Energy Code
WUTC	Washington Utility and Transportation Commission

Appendix B: EEAG Meeting Minutes

MEETING SUMMARY	
Topic:	EEAG January Interim Meeting
Date:	January 29, 2024 – 2:00 pm to 3:30 pm
Attendees:	NW Natural: Kellye Dundon, Laney Ralph, Natasha Siores, Rebeca Enriquez, Rebecca Trujillo, Tavia Henley-Storm Clark County WX: Nichole Piesik Energy Project: Shaylee Stokes Energy Trust: Andrew Shepard UTC: Byron Harmon, Emily Gilroy, Joshua Dennis

KEY DISCUSSION ITEMS

1. Welcome/Intros
2. BEE Pilot
3. Upcoming Items
4. Proposed Q1 Agenda
5. Questions/Wrap Up

ACTION ITEMS

Description	Lead	Due Date
Share WA Tariff prior to filing	Laney	2/2/2024

NOTES

Laney presented an update on the Behavioral Energy Efficiency (BEE) Pilot and upcoming changes to the Washington tariff. Andrew gave a brief update on Energy Trust's programs. When asked about Q1 agenda items, Shay expressed wanting to learn more about the low-income program as they're new to the group. Emily expressed wanting to hear more about the BEE evaluation process as it advances. To conclude, Laney let the group know that the tariff filing will happen thirty days after it has been shared with the EEAG and will include the timeline for feedback.

MEETING SUMMARY	
Topic:	EEAG Q1 Meeting
Date:	March 25, 2024 – 1:00 pm to 2:30 pm
Attendees:	NW Natural: Haixiao Huang, Kellye Dundon, Laney Ralph, Matthew Doyle, Natasha Siores, Rebeca Enriquez, Tavia Henley-Storm Clark County WX: Nichole Piesik Energy Project: Shaylee Stokes Energy Trust: Kyle Kent NEEA: Becca Yates, Becky Walker UTC: Joshua Dennis ATG PCU: Corey Dahl Community Action Council of Lewis, Mason, and Thurston: Stephenie Arnold Nathan Krebs

KEY DISCUSSION ITEMS

1. Welcome/Intros
2. NEEA Presentation
3. IRP – Social Cost of Carbon
4. Energy Trust 2023 Results
5. Program Updates
6. Next Steps/Wrap Up

ACTION ITEMS

Description	Lead	Due Date
UTC's question on participation rates and new customer count data on new construction EE program	Andrew	ASAP
Provide breakdown of geographic data for BEE Pilot	Laney	Q2 EEAG Meeting
Provide 2022-2023 EE report for feedback	Laney	May 1, 2024

NOTES

Becca Yates and Becky Walker joined to deliver a NEEA presentation. Becky addressed Matt's query about RBSA data and its usage, mentioning that while there may not be specific trainings, analysts at NEEA can provide one-on-one guidance. Kyle Kent, filling in for Andrew, presented Energy Trust's 2023 annual results. He highlighted the strong performance of the commercial program and the challenges faced in the residential program, such as not being able to provide smart thermostats, though they've become a crucial part of the residential portfolio over last five years. Joshua raised a question about NW Natural's new construction energy efficiency program and what its participation rates are, if the program is still slated to terminate this year (and when), and what the data on new customer counts looks like. Kyle is taking this back to Andrew for follow up. Rebeca reviewed the 2023 numbers and program updates for the WA Low Income Energy Efficiency program, announcing a surpassed goal for weatherization jobs and tune-ups, and that the $4k increase for health and safety measures was approved. Laney provided updates on the BEE Pilot program, mentioning that most people click through for fireplace and furnace rebate offers, driving more people to Energy Trust incentives. Shaylee asked for a breakdown of client characteristics participating in the pilot, to which Laney responded that geographic data could be pulled out, but is not readily available, and that income level data is not being tracked. Laney concluded with the completion of the first biennial period in 2023, and that an energy efficiency report covering 2022 and 2023 will be drafted and out to everyone by May 1 and asking for any feedback by May 31, as the filing date is June 14. A review of this report will be on the agenda for our Q2 meeting.

MEETING SUMMARY	
Topic:	EEAG Q2 Meeting
Date:	May 9, 2024 – 3:00 pm to 4:30 pm
Attendees:	NW Natural: Kellye Dundon, Laney Ralph, Natasha Siores, Rebeca Enriquez, Rebecca Trujillo, Tavia Henley-Storm Energy Project: Shaylee Stokes Energy Trust: Andrew Shepard UTC: Emily Gilroy

KEY DISCUSSION ITEMS

1. Welcome – Check-in
2. Preliminary Draft Overview
3. Portfolio Evaluation
4. Behavioral Pilot Updates
5. Energy Trust Updates
6. Next Steps/Wrap Up

ACTION ITEMS

Description	Lead	Due Date
Biennial EE Report Feedback	EEAG Group	June 1, 2024
Breakdown of geographic data for BEE Pilot	Laney	August 14, 2024 (Q3 Meeting)

NOTES

Laney presented on the 2022-2023 Biennial Energy Efficiency Report, asking if there were any additional items we'd like to see in the biennial report not included in annual reports. We're encouraged to reach out, if so. She gave update on the portfolio evaluation, announcing that Evergreen Economics had been selected as an evaluator. An evaluator for the BEE program is still in process and wrapping up.

Rebeca presented on the low-income evaluation. Shay asked about the deemed measures list and what it would be replacing, and Rebeca explained that the program receives savings through REM reports used by some agencies. Shay then asked if there was a timeline for the contracting process, to which Rebeca answered that the process will begin within the next couple months and be completed late this fall. Emily ask why the low income weatherization program achieved a low percentage compared to the other programs? Because it is such a small program with small projects coming through in a year. In the 2021 CPA, a low-income analysis was done and showed that only 3% of NW Natural customers were low-income. It's been historically hard to reach these customers within a very small section of service territory. Rebeca added that challenges coming out of the pandemic greatly affected the program and that the cross-promotion with the BEE program has been working and they've been receiving a lot more calls about the program. Emily also asked if there had been any plans, developments, or engagements with non-energy impacts with the EEAG, to which Laney answered that though there has not been extensive engagement on non-energy benefits specifically, Energy Trust does include non-energy benefits in their measure analysis, and it is something that will be looked at in the low income evaluation.

Andrew gave Energy Trust updates, expressing that the residential is on track and that Q1 saw good results on the commercial side, largely due to Strategic Energy Management (SEM). SEM is a program offering introduced a couple years ago and is now seeing significant savings come in. On slide 14, Andrew emphasized the table line item 'study', which is representative of energy studies ETO helps to fund for respective clients and NW Natural customers. The study looks to determine what sort of upgrades can be done in the building—what is the cost of doing them, what is the energy savings, and what is the energy bill savings. As more of these will be seen as WA legislature comes into play, this is a line item to pay attention to over the next year or so. When presenting on

the residential income qualified offerings, Emily raised a question about how incentive rates can encourage participation with an eye to how much of an incentive is enough to make customers take action versus being aware of over-incentivizing for a measure. Andrew mentioned that historically, when looking at the Energy Trust program, by and large the market rate incentives cater to households that are making upwards of $100,000/year or more. The programs weren't being utilized by moderate income households. When cost effective screenings are done for measures, ETO defines through that screening what the maximum incentive could be, then figuring out what can be offered below that maximum incentive that can still complete the job. This offering has allowed many Oregon households to make improvements that they otherwise would not have been able to make. Shayl then asked if the state median income in the proposal is to be aligned with Oregon in terms of program design? Has area median income been considered to target the urban versus rural service territory and smaller area in general? Andrew mentioned this being worth exploring and that WA is diverse and that perhaps SW WA isn't reflective of the state as a whole. Shay added that it may make cross referrals from the bill assistance programs for NW Natural's WA customers make a direct connection. Lastly, Andrew touched on the option of increasing ETO's market rate gas furnace incentive to a value of $800 instead of $650, mainly to respond to inflation.

Laney provided updates on the BEE Pilot program and program cross promotion. The geographic display of program participants should be ready to share by the Q3 meeting. Savings projects from Bidgely are still tracking and projecting ahead of what was originally participated. This could be driven by cost increases in WA as well and will be interesting to see how this program performs in the second year of operating.

Laney concluded with an overview of next steps and the proposed Q3 meeting agenda. If there are any requests, please reach out for consideration.

MEETING SUMMARY	
Topic:	EEAG Q3 Meeting
Date:	August 14, 2024 – 1:00 pm to 2:30 pm
Attendees:	NW Natural: Kellye Dundon, Laney Ralph, Natasha Siores, Rebeca Enriquez, Rebecca Trujillo, Tavia Henley-Storm Clark County: Nichole Piesik Energy Project: Shaylee Stokes Energy Trust: Andrew Shepard NWEC: Mike Goetz UTC: Andrew Roberts, Byron Harmon, Emily Gilroy, Joshua Dennis,

KEY DISCUSSION ITEMS

1. Welcome – Check-in
2. Reporting Update
3. Evaluations
4. Program Updates
5. Next Steps/Wrap Up

ACTION ITEMS

Description	Lead	Due Date
Provide link to open recessed meeting	Laney	ASAP
Moderate-income offering: Total project cost averages and how increased incentive has impacted projects.	Andrew	Q4 EEAG Meeting

NOTES

Laney provided a update on the biennial energy efficiency report filed on June 14th. A copy of that filing was sent out, but please reach out if you didn't receive it. Laney highlighted the upcoming Recessed Open meeting on August 22nd at 9am. Mike asked if it's typical for the commission to take a hard look at these filings, to consider what type of feedback might be helpful for them to consider. Laney provided background of both the biennial reports and annual reports—the 2-year cycle is where the most diligence and review happens, whereas the annual reports are updates on progress. With equity, low-income programs, and plans for the pilot programs ongoing, feedback has been collected and heard, and next round there will be an equity specific section to focus on all the different efforts going on and what steps are being taken to address concerns from commissioners. Joshua also added that in addition to offering summaries to commissioners, there is also an opportunity for stakeholders to provide a short presentation to commission during the recess open meeting.

While discussing annual planning, Laney expressed wanting to have draft budgets available for our next EEAG meeting in October. We'll look at where we landed compared to what was filed within our biennial plan and help address any questions or adjust as needed.

Laney then provided updates on all evaluation work. The RFP process for both the evaluator for the BEE Pilot and low-income programs is complete. Once contracting is finalized, the low-income evaluation will begin as soon as possible and the BEE Pilot evaluation will start once a full year of program data has been collected, around mid-November. We hope to wrap up this evaluation around March, so the evaluation findings can be included within our annual report to be filed in June of 2025. Laney also noted that this is different from the evaluation work that Energy Trust conducts on their programs. Joshua if the WALIEE program would be evaluated. Rebeca responded that yes, it would be part of the low-income evaluations, for both Oregon and Washington.

For industrial audit updates, that offering has been winding down over the last year and a half, with six audits performed by Energy350. They conducted onsite assessments, documented all their equipment, and looked for different energy efficiency measure that could be implemented at each of the sites. A final summary report will be shared with the group, aiming for September, which will inform how we plan to move forward with a program. If helpful, Energy350 could be asked to attend the October meeting to answer any questions on the report.

Nichole provided an update on low-income weatherization with Clark County. For the year through November, they'll have 10 full weatherization projects for gas clients and 2 repair-only projects. On average, projects usually range from $14k-$20k. Nichole also shared on a program they're working on for customers with a little higher of an income level. If accepted by council, it will be for 80% AMI households. Referrals will be received as usual through Clark PUD. They will be determining if heating units are accurately heating the client's homes, replacing units older than five years with more energy efficient heating units where appropriate, specifically ductless heat pumps.

Andrew gave Energy Trust updates, noting that their year-to-date savings are higher than typical at mid-year, currently at 108,432 therms, 40% of their total goal. He mentioned it being a slow year for the energy performance score (EPS), and that they're working with builders to get in any remaining homes they've had in their pipeline. Otherwise, they're not offering a new program for new construction. It will be based on the old code and getting homes in through the program that were permitted under that old code. Andrew explained that they run a forecast of their programs every two weeks, and it looks like they're going to meet the annual savings goal for commercial. They'd previously forecasted coming well above their goal, but some larger projects have been shifted to next year. A good driver through their program has been their custom studies, which are performed for bigger commercial projects. The custom studies show customers how much energy and money could be saved through specific energy efficiency measures and the potential incentive available. Through cross-effective metrics, ETO wants to make sure they're maximizing the amount that can be given to the customer, while still making sense for the budgets of both parties. They're finding that they're running up against a space where costs are quite high and they're hearing about these budget concerns from customers. While currently working on their 2025 budgets, there will be an impact related to some of the market tightening up a bit. More will be shared on this at our next meeting. Laney asked, related to the clean buildings program and additional incentives available for early adopters, if that has been a part of the conversations for the custom studies. Andrew stated that there are customers looking to utilize these additional incentives and execute on these projects. He also noted that there are other buildings, because of budgetary reasons, that are not considering these types of projects yet. It's a combination of both these scenarios across the board. He mentioned that on the residential side, they're seeing a bit of retraction in gas furnaces, but nonetheless, gas furnaces are still the largest driver of savings, followed by insulation measures. Because of previous campaigns, smart thermostats are doing well, and they are meeting goals this year as related to the number of thermostats on the market. On a big note, an income-qualified offering launched this month for moderate-income households. These incentives are provided in efforts to drive savings and benefit that housing market demographic. It is a $1200 gas furnace (double the standard) incentive to help lessen the burden of the HVAC replacement. Next year, they'll be expanding the income-qualified offerings to include some of their insulation measures—ceiling, floor, and wall. On a final note, Andrew spoke on their windows incentive. Window measures have been highly dependent on window installers as they were previously the entity informing customers of the incentives available and completing the applications on their behalf. ETO has worked closely with them to make sure they not only know what the incentives are, but that they're available and can show clients how to claim them. Some of their installers have informed them that they do not have the bandwidth or resources to provide that service to customers anymore. They are now developing more materials to bridge

that gap and make the windows measure more friendly, so that customers are still well-served through these programmatic offerings. Laney added that it would be helpful to have an update in 2025 on the learnings from the windows and how ETO has pivoted from that. Shay asked about the moderate-income incentive and if it's a rebate. Andrew explained that it will be provided in a format called instant incentive—the contractor provides the incentive to the customer on the invoice. The invoice is reduced, the contractor floats that incentive, and ETO pays the contractor after the fact. Shay added that it'd be of interest for the group to see figures on total project cost averages and how that incentive has impacted the project. Andrew stated he believes ETO has that information for both Oregon and Washington and will see what he can find. Shay then asked how customers income qualify. Andrew explained it is up to the customer to self-identify through contractors that work within this offering. These contractors need to take additional training and sign a participation agreement in order to provide this incentive. They will provide the customer with the information for the customer to determine if they qualify. Laney added that if we've done any evaluation on the Oregon side for Savings Within Reach, it would be useful for this group to see as it's a new offering in Washington.

Laney concluded with an overview of next steps and the proposed Q4 meeting agenda. If there are any requests, please reach out for consideration.

MEETING SUMMARY	
Topic:	EEAG Q4 Meeting
Date:	October 17, 2024 – 10:30am to 12:00 pm
Attendees:	NW Natural: Kellye Dundon, Laney Ralph, Natasha Siores, Rebeca Enriquez, Rebecca Trujillo, Mary Rudolph-Knobbe Clark County: Nichole Piesik Energy Trust: Andrew Shepard AWEC: Chad Stokes UTC: Andrew Roberts, Byron Harmon, Emily Gilroy, Joshua Dennis,

KEY DISCUSSION ITEMS

1. Welcome – Check-in
2. 2024 Program Update
3. Industrial Audit Report
4. 2025 Budget Review
5. Energy Burden Assessment
6. Upcoming Items

ACTION ITEMS

Description	Lead	Due Date
Send out final Industrial Audit Report	Laney	ASAP
Respond to 2025 availability poll	EEAG	Nov. 15th, 2024

NOTES

2024 Program Updates:

Laney provided an update on the BEE pilot. Savings are still trending above the initial forecast and feedback is still primarily positive. Savings shown are not evaluated; ADM is expected to begin their evaluation in November and there may be a depreciation of the reported savings. Emily asked about the frequency of utility communications as they relate to program opt-outs. Laney explained that enrolled customers receive a monthly email, which is needed to influence behavior for the program. Laney will follow-up with information about frequency of general NW Natural communications and preference options. Joshua asked if the increased savings would impact the program cost. There is not an incentive associated with the program, so increased savings will not increase program costs. Costs are primarily driven by platform fees and mailed paper reports.

Rebeca E. provided an update on the WA-LIEE program. Clark County is on track to meet their goal of 10 homes.

Andrew S. provided an update on the Energy Trust commercial and residential programs. The programs achieved 23% of the annual goal in Q3. Andrew noted the levelized costs/therm in the table are incomplete and do not include all cost data for Q3. Looking at the program forecasts, the commercial program may have a couple of projects that get pushed into 2025. If this happens, the commercial program may fall short of the 2024 goal. Residential program savings may also be a bit short as there has been decreased furnace activity.

Industrial Audit Report:

The industrial audit pilot has concluded. 6 industrial sites participated and a range of measures from O&M to capital intensive projects were identified. The savings versus estimated costs were shown in a graph. This information will be used for formalizing a program in 2025.

2025 Budget and Savings Review

Laney presented the updated 2025 budget as compared to what was filed in the 2024-2025 Biennial Energy Efficiency Plan (BEEP). Not all the budget numbers for each program are final yet. The overall therm goal for 2025 is lower than what was originally filed in the BEEP. NW Natural is still anticipating being able to meet the BEEP goal with extra savings generated by the BEE Pilot to make up for the reduction in savings from the residential and commercial incentive programs.

Energy Burden Assessment

Rebeca E. presented a high-level overview of NW Natural's recently completed Energy Burden Assessment. Information provided included data-sources used, the overview of NW Natural's residential sector, and recommendations from the assessment. Byron asked about the median income, and why it was higher than what is reported by the state. Rebeca E and Natasha helped answer the question by explaining this is specific to NW Natural customers and that third party data used was household specific. Byron asked about the potential for selection bias. It was noted that gas customers are a subset of the populations and that the Oregon numbers also showed a higher level of income for gas customers.

Upcoming Items

Laney gave an overview of upcoming activity. NW Natural is currently conducting a Request for Proposals for the 2025 Conservation Potential Assessment.

NW Natural is looking to schedule the 2025 EEAG meetings. There was interested in continuing to have the interim January meeting to check-in between the quarterly meetings. Laney provided a link to the doodle poll to gauge best days/times to hold the quarterly meetings.

Appendix C: Behavioral Energy Efficiency Evaluation

EM&V REPORT: NW NATURAL BEHAVIORAL ENERGY EFFICIENCY PROGRAM

SUBMITTED TO:

NW NATURAL

SUBMITTED BY:

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ADM

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1 ACKNOWLEDGEMENTS

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2 CONTENTS

3 EXECUTIVE SUMMARY

This report is a summary of the impact evaluations for NW Natural's Behavioral Energy Efficiency Program in Washington.

Table 1-1 summarizes the programs included in the evaluation effort and ADM Associates, Inc. (herein referred to as the "Evaluators") impact evaluation tasks and impact methodology for each program.

Table 1-1 Impact Evaluation Activities by Program

Program Type	Program	Database Review	Impact Methodology	Program Years
Energy Efficiency	Behavioral	✓	Randomized Control Trial (RCT)	PY2024

3.1 Program Design

To facilitate understanding of the Behavioral program design, the Evaluators developed a draft logic model (see Figure 1-1). This draft was synthesized from the Evaluator's experience with similar programs. The Evaluator sought to create a model that could be viewed as a "living document" that could assist program staff, implementation staff, and evaluators in understanding the program's underlying operations.

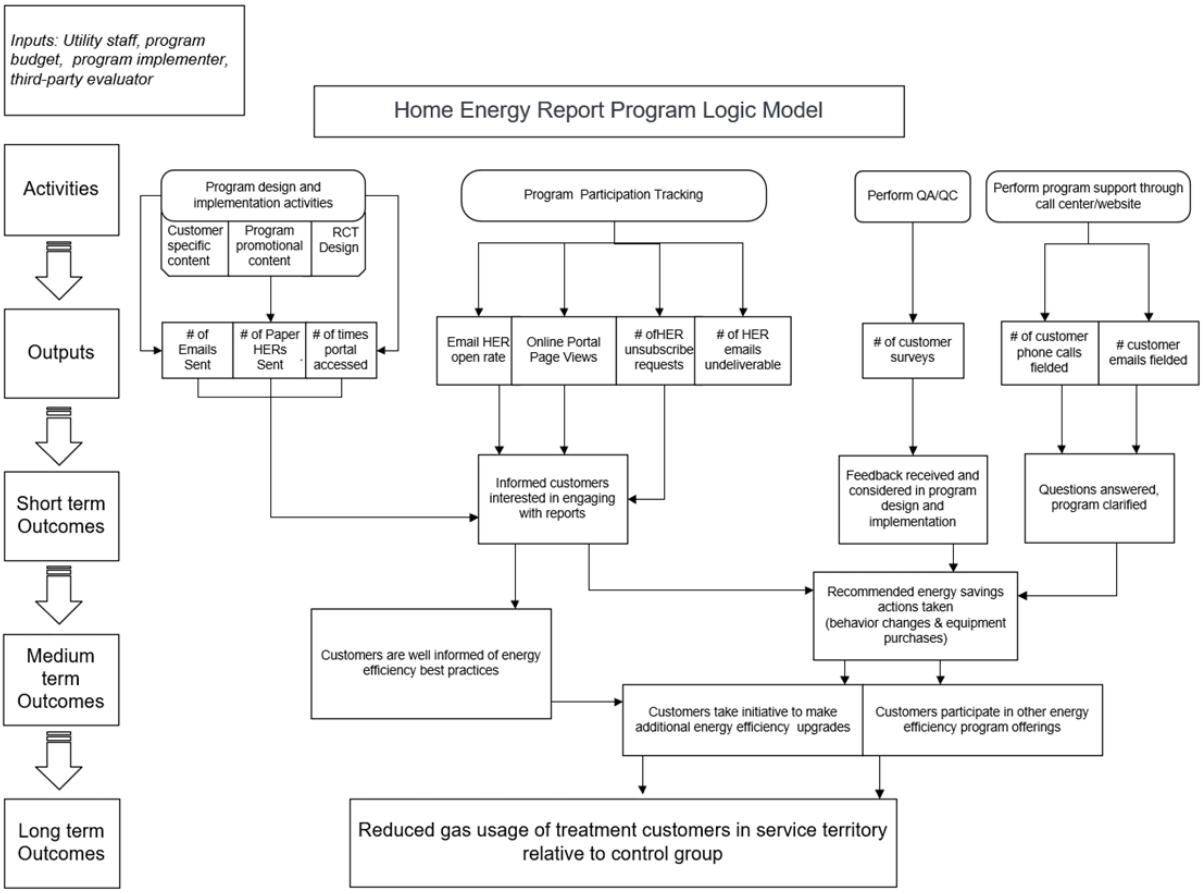

Figure 1-1 Behavioral Program Logic Model

NW Natural launched the program in Q4 of 2023 and it was implemented with an opt-out, randomized control trial (RCT) design. Behavioral programs are typically designed to provide information to residential customers intended to encourage behavioral changes that result in reduced billed energy consumption. The household receives personalized information about their own natural gas consumption and comparison to a group of neighboring households energy consumption. Also typically included in the reports is information on other NW Natural energy efficiency programs to encourage additional home improvements towards reduced energy usage. This normative information on gas usage and targeted tips on energy saving behaviors is aimed at reducing the participant household's energy consumption.

Table 1-2 summarizes the cohorts implemented in the Behavioral program within the NW Natural Washington service area.

Table 1-2 Summary of WA Behavioral Cohort

Cohort	RCT Date	Treatment Group Size			Control Group Size		
		Original Treatment Customers	Number at Start PY2024	Number at EOY PY2024	Original Control Customers	Number at Start PY2024	Number at EOY PY2024
WA	10/20/2023	48,062	47,225	44,408	13,910	13,659	12,783

The Evaluators estimated savings for the Behavioral Program using non-participant residences in NW Natural's service territory selected from the Randomized Control Trial (RCT) and analyzed each of the cohorts treated during PY2024. Table 1-3 describes the evaluation period for each cohort and reporting period.

Table 1-3 Summary of Cohort Organization

Cohort	RCT Date	Pre-Period	Post-Period
WA	10/20/2023	6/2/2022-10/19/2023	PY2024: 1/1/2024 - 12/31/2024

3.2 Summary of Data Provided

The implementer Bidgely provided the following data to support the analysis:

- Pre- and post-treatment monthly gas billing data for participants and non-participants. The data started in June of 2022 and ended January 3, 2025.
- Behavioral program customer information, including date of first sent paper and email. Behavioral report by Bidgely, opt-out date, and treatment or control group assignment.
- Residential downstream program data, including customer information, completed measures, and associated annual household Therms savings.

3.3 Verified Savings

The Evaluators' analysis yields an estimate of gross verified Therms savings for the program, as shown in the table below. The total program gross verified savings were 197,373 Therms in PY2024.

Table 1-4: Behavioral Program Savings Summary

Cohort	Annual Savings Per Home (Therms/year)	5% CI Annual Savings Per Home (Therms/year)	95% CI Annual Savings Per Home (Therms/year)	Annual Adjusted Savings Per Home[1] (Therms/year)	Total Program Verified Savings (Therms)
WA	4.51	3.73	5.30	4.40	197,373

3.4 Conclusions and Recommendations

The following section details the Evaluators' conclusions and recommendations for the Behavioral program.

Conclusion: Behavioral Program verified annual savings of 197,373 Therms for PY2024 are positive and statistically significant at the 90% level for the Washington cohort.

- The evaluated WA cohort had a valid control group which suggests that the creation of the original RCT cohort by the implementer was done in accordance with industry standards.
- The evaluated cohort displayed average annual gas savings of 0.66 percent of annual billed use in PY2024. In the Evaluators' experience, typical behavioral programs display average annual gas savings between 0.25 percent and 2 percent. This is the first program year for the WA cohort, and behavioral program savings often increase in later program years.
- Downstream and upstream double counted savings were 4,870 Therms for PY2024. The double counted savings were removed from the estimated savings from the regression results. The double counted savings represent two percent of program savings before double counting, therefore, the impact on final program savings was insignificant in percentage terms. The observed double counted savings is expected, as Uplift's percentage of program savings is typically between 1 percent and 3 percent.
- The annual attrition rate in PY2024 is roughly 6 percent for the WA cohort for both the treatment and control groups.

Recommendation: Save and store historical billing data for all customers in each wave to ensure future analyses will have one year of billing data prior to the RCT start date for each customer, as well as complete billing data after the intervention.

Conclusion*:* The post-period was defined as 12 months and a measure life was not defined for the program.

Recommendation: Assume a 1 year measure life for ongoing Behavioral programs or change the cohorts each year to claim a longer measure life for savings.

[1] These savings are adjusted to remove double counted savings caused by Behavioral program induced Uplift. Uplift increases participation in other Energy Efficiency programs for Behavioral program treatment customers relative to Behavioral program control customers.

3.5 Report Organization

From this point, the remaining report chapters include:

- Chapter 2: General Evaluation Methodology
- Chapter 3: Impact Evaluation Results
- Chapter 4: Conclusions and Recommendations

4 GENERAL EVALUATION METHODOLOGY

The Evaluators completed an impact evaluation for the program/s summarized in the Executive Summary. Our activities estimate and verify annual savings and provide energy savings from a single source, aimed at providing guidance for continuous program improvement.

4.1 Glossary of Terminology

As a first step to detailing the evaluation methodologies, the Evaluators have provided a glossary of terms to follow:

- **Verified Savings** – Savings estimates after the impact analysis and energy impact evaluation has been completed.
- **Gross Savings** – The change in energy consumption directly resulting from program-related actions taken by participants in an efficiency program, regardless of why they participated.
- **Pre-Period –** The period prior to the treatment intervention, typically set to equal a one-year period.
- **Post-Period –** The period after to the treatment intervention, typically set to equal a one-year period.
- **Cohort –** The group of treatment and control customers defined by a Randomized Control Trial (RCT); often referred to as a wave in behavioral programs.
- **HDD –** Heating degree days (HDD) are a measurement used to estimate the amount of energy required to heat a building or space during a specific period, typically a day or a month. It is primarily used in regions with cold climates to assess the demand for heating and to evaluate energy consumption.
- **Dummy Variable -** A dummy variable, also known as an indicator variable or binary variable, is a categorical variable that takes on one of two values to represent the presence or absence of a characteristic or condition. It is commonly used in statistical analysis and regression modeling to represent qualitative factors and typically takes the value of 0 or 1, where 0 represents the absence or reference category, and 1 represents the presence or alternative category.

4.2 Impact Evaluation Approach

4.2.1 EVALUATION APPROACH

The Evaluators estimated verified savings for the Behavioral Energy Efficiency Pilot Program for Program Year 2024.

The work effort was divided into three categories:

1. Estimate monthly and annual billed consumption differences between treatment and control groups via regression modeling;
2. Estimate joint savings from other programs; and

3. Conduct an attrition analysis.

The Evaluators utilized participant and control group billing data in the pre-period (before the household starts receiving home energy reports) and in the post-period (after household starts receiving home energy reports) to estimate program persistence of savings for each cohort. The Evaluators also estimated joint savings from other downstream energy efficiency programs offered to NW Natural residential customers. No upstream programs were provided by NW Natural to customers in 2024, therefore, no adjustment for uplift from upstream programs was needed. The joint savings were removed from the regression analysis results to estimate verified persistence savings due to the Behavioral Energy Efficiency Pilot Program.

The following research questions were addressed in the evaluation and presented in the report:

- What are the household-level impacts across participants due to receiving the behavioral reports?
- What is the attrition rate for this first wave of cohorts?
- What is the magnitude of double counted savings for participants in the treatment and control groups, respectively?
- Is the implementer's program design consistent with standard behavioral program designs?

4.2.1.1 Billing Analysis Methods

The Evaluators utilize different impact evaluation approaches for the persistence savings evaluation of behavioral EE programs. The final approach utilized is determined during the impact evaluation. Each approach involves panel linear regression models to estimate energy savings for the treatment group. One of the methods requires a designated control group to be created by the Evaluators in instances where the control group as designed does not pass equivalency checks (which may occur as the result of customer attrition).

Both approaches are recommended by the National Renewable Energy Laboratory (NREL) in the Uniform Methods Project (UMP) as a viable regression framework that can be applied to long-term participation and persistence of savings. These proposed methods require monthly or bi-monthly billing data for the program participants[2].

The following types of regression models were explored during the evaluation of this program: Difference in Difference (D-in-D) and Post-Program Regression (PPR). The Uniform Methods Project (UMP) by the National Renewable Energy Laboratory (NREL)[3] recommends D-in-D and PPR regression models as they use data from the treatment and control groups during the pre- and post-period and therefore obtain more precise savings estimates. The PPR model is a panel regression model that calculates the differences between treatment and control consumption in the post-program period. However, it includes controls on lagged energy use for the same calendar month of the pre-period to include in the model any small systematic differences in pre-treatment usage trends between the participant and control customers.

[2] https://www.nrel.gov/docs/fy17osti/68569.pdf
[3] https://www.nrel.gov/docs/fy21osti/77435.pdf

The Evaluators present the following two methodologies:

1. Method 1: D-in-D or PPR billing analysis with RCT
2. Method 2: D-in-D or PPR billing analysis with post-hoc control group

The first method requires the RCT for the cohort remains statistically valid. Validity is determined by examining average usage in the pre-treatment period for customers in the treatment and control group (after having accounted for program attrition). Each monthly read is tested for statistically significant differences (using a *t*-test). The second requires the Evaluators to create a quasi-experimental control group to compare against participant billing data if the cohort RCT is no longer valid. Both methods utilize a fixed effects panel regression controlling for weather to estimate energy savings.

To gather the most reliable results, it is ideal to have a randomized control trial (RCT). However, some RCTs may become no longer viable due to changes in implementation or significant attrition. The Evaluators test the validity of each RCT by completing *t*-tests for the average daily gas usage of each of the pre-period months between the treatment group and the control group. If the pre-period average daily usage rejects the null hypothesis at the 90% confidence interval for three or more of the 12 pre-period months, the RCT is considered invalid[4]. In cases where the control group is no longer valid, the Evaluators utilize a method for producing post-hoc control groups via quasi-experimental methods (e.g., propensity score matching).

The Evaluators present savings estimates in three formats for each program year:

- Daily and annual energy savings per home
- Annual percent savings per home
- Program-level savings

The percentage savings per home is calculated by dividing the average annual energy savings estimated in the treatment group by the average annual energy consumption from the control group for each program year. The program-level savings are calculated by multiplying the average annual household persistence estimate by the number of program participants in the treatment group and after removing double counted savings, by program year.

4.2.2 DATA REQUIREMENTS

The Evaluators estimated the Behavioral Energy Efficiency Pilot Program energy savings through a billing analysis. The following data was provided by NW Natural and the program implementer Bidgely:

- Participant and nonparticipant customer information;
- Treatment and control customer monthly billing data in pre-period through post-period; and,
- Tracking data from NW Natural downstream energy efficiency programs in each evaluated program year.

[4] Statistically significant differences in usage for three or more pre-period months is very unlikely to occur randomly with an alpha of 0.05 for each t-test (probability < 0.05). However, statistically significant differences in usage does occur for one or two pre-period months regularly (probability > 0.4 with an alpha of 0.05 for each t-test), but this does not indicate that a cohort is statistically invalid.

4.2.3 DATA PREPARATION

The Evaluators utilized participant and non-participant billing data in the pre-period (before intervention of the behavioral reports) and participant and non-participant billing data in the post-period (after intervention of the behavioral reports) in a fixed-effects panel regression model to predict average annual household gas savings, as detailed in the UMP behavioral chapter.

The following steps were taken to prepare data:

- Identify homes in the billing data that were assigned to the treatment or control group in the original RCT design
- Exclude homes without sufficient billing history
- Exclude homes without sufficient post-period billing data
- Exclude homes with consumption data indicating it is an outlier
- Verify if remaining RCT control households are still a valid comparison for the remaining treatment households

The Evaluators examined data for outliers using multiple accepted identification techniques. These include simple Z-scores, Bonferroni Outlier Test, Grubbs Test for Outliers (G-test). The Evaluators aim to remove error reading rather than remove high and low users, as these subgroups contribute real behaviors to the average savings estimate.

The Evaluators report parameters necessary to portray model accuracy and significance such as coefficient p-values, adjusted R-squared values, and measure-level savings at 90% confidence intervals. Program year savings estimates at the monthly- and annual-level were also reported for the measure.

4.2.4 METHOD 1: BILLING ANALYSIS WITH RCT

The approach indicated under Method 1 utilizes the control group created during the RCT design in either a D-in-D or PPR model. This requires a successful validation test between the cohort's treatment and control group. This approach is detailed in the UMP as a preferred method for evaluation of opt-out behavioral programs. The following sections summarize the two model specifications we will explore during analysis under Method 1.

4.2.4.1 Difference-in-Difference Model Specification

The fixed-effects model specification contains customer-specific dummy variables to account for exogenous heterogeneity that cannot be explicitly controlled for and is not relevant to the estimation of program savings. The specification of customer specific effects allows the model to capture much of the baseline differences across customers while obtaining reliable estimates of the treatment effect of the report.

The Evaluators included independent variables such as Heating Degree Days (HDD) to improve model confidence. The Evaluators utilized a fixed effects panel regression model to estimate weather-dependent daily consumption differences between treatment and control households.

Equation 2-1: Fixed-Effects Difference-in-Difference (D-in-D) Panel Regression Model Specification

$$ADC_{it} = \alpha_0 + \beta_1(Post)_{it} + \beta_2(Treatment)_{it} + \beta_3(HDD)_{it} + \beta_4(Post \times HDD)_{it} + \beta_5(Post \times Treatment)_{it} + \beta_6(Post \times HDD \times Treatment)_{it} + \varepsilon_{it}$$

Where,

ADC_{it} = Estimated average daily consumption (dependent variable) in home *i* during period *t*

$Post_{it}$ = Dummy variable indicating whether period *t* was in pre- or post- retrofit

$Treatment_i$ = Dummy variable indicating whether household *i* was in treatment group or control group

HDD_{it} = Average heating degree days during period *t* at home *i*

ε_{it} = Customer-level random error

α_0= The model intercept for home *i*

β_{1-6} = Coefficients determined via regression

The coefficients β_5 and β_6 represent the average change in daily weather-related consumption between the groups in the post-period. HDD was calculated from local weather data and was estimated using a temperature base point set to 65 degrees.

4.2.4.2 Post-Program Regression Model Specification

The post-program regression (PPR) model combines both cross-sectional and time series data in a panel dataset. This model uses only the post-program data, with lagged energy use for the same calendar month of the pre-program period acting as a control for any small systematic differences between the participant and control customers. In particular, energy use in calendar month *t* of the post-program period is framed as a function of both the participant variable and energy use in the same calendar month of the pre-program period. The underlying logic is that systematic differences between participants and controls will be reflected in differences in their past energy use, which is highly correlated with their current energy use. The version we estimate includes monthly fixed effects and interacts these monthly fixed effects with the pre-program energy usage. These interaction terms allow pre-program usage to have a different effect on post-program usage in each calendar month.

The model specification is as follows:

Equation 2-2 Fixed-Effects Post-Program Regression (PPR) Model Specification

$$ADC_{it} = \alpha_0 + \beta_1(Treatment)_i$$
$$+\beta_2\ (PreUsage)_i$$
$$+\beta_3\ (HDD)_{it}$$
$$+\beta_4(Month)_t$$
$$+\beta_5(Month \times PreUsage)_{it}$$
$$+\beta_6(HDD\ \times Treatment_{)it}$$
$$+\varepsilon_{it}$$

Where,

i = the *i*th household

t = the first, second, third, etc. month of the post-treatment period

ADC_{it} = Average daily usage for reading *t* for household *i* during the post-treatment period

$Treatment_i$ = Dummy variable indicating whether household *i* was in the treatment or control group

$Month_t$ = Dummy variable indicating month-year of month *t*

$PreUsage_i$ = Average daily usage across household *i*'s available pre-treatment billing reads

HDD_{it} = Average heating degree days during period *t* at home *i*

ε_{it} = Customer-level random error

α_0= The model intercept for home *i*

β_{1-6} = Coefficients determined via regression

The coefficients β_1 and β_6 represent the average change in consumption between the pre-period and post-period for the treatment group.

4.2.5 METHOD 2: BILLING ANALYSIS WITH QUASI-EXPERIMENTAL CONTROL GROUP

Due to complications in program implementation or design (or as the result of significant participant attrition), RCT groups may at some point become invalid. When this occurs, the Evaluators estimate savings through a quasi-experimental control group.

The Evaluators verify if each cohort has a valid experimental design by reviewing pre-period billed energy consumption between the treatment and control groups for each cohort. If randomization testing proves the treatment and control groups are no longer a valid match for a wave or if a randomized controlled trial (RCT) was not conducted for a cohort, the Evaluators create a valid post-hoc control group from nonparticipant billing data via quasi-experimental methods. Quasi-experimental methods are required when the control group has not been randomly assigned as it would be in a RCT.

The Evaluators create a statistically similar control group using propensity score matching (PSM), a method that finds the most similar household based on the customers' billed consumption trends in the pre-period and verified with statistical difference testing. A propensity score is a metric that summarizes several dimensions of household characteristics into a single metric that can be used to group similar households.

To create a post-hoc control group, the Evaluators must compile billing data for a potential control group to compare against treatment households via quasi-experimental methods.

The variables typically matched on include, but are not limited to:

1. Seasonal or monthly pre-usage
2. Household zip code.

The PSM method ensures to the extent feasible that average characteristics of the treatment and comparison groups are similar, resulting in minimal bias within a non-RCT design.

The Evaluators ensure the control group is statistically similar to the treatment group by conducting a hypothesis t-test for each month in the pre-period between each group. If the post-hoc control group

passes the *t*-test for the majority of pre-period months, and the groups are validly balanced, the Evaluators continue with the linear fixed effects D-in-D or PPR model presented in Equation 2-1 and Equation 2-2.

4.2.6 REMOVE DOUBLE COUNTED SAVINGS

After regression models have been finalized, the Evaluators estimated and removed double counted savings found from the customers in the treatment group from other NW Natural energy efficiency programs.

The NW Natural Behavioral Energy Efficiency Pilot Program reports may increase the customer's propensity to participate in other programs. This additional participation is known as uplift. The behavioral reports sent to customers may include information about other NW Natural incentives and programs, which may lead to customers adopting more energy efficient upgrades for their home. When a household participates in an efficiency program because of this encouragement, the utility might count their savings twice: once in the regression-based estimate of behavioral program savings and again in the estimate of savings for the other energy efficiency program. Although uplift rarely displays a statistically significant difference between the treatment and control groups, the UMP recommends removing uplift from each group at the household level.

The Evaluators estimated savings from program uplift and subtracted it from the efficiency program portfolio savings. To achieve this, the Evaluators gathered information on the total natural gas Therms saved in "other programs". The double count savings were calculated at a per-household level for each treatment group in each cohort as follows:

Equation 2-3 Double Count Specification

$$Double\ Counting = \left(\frac{OP\ Therms}{Household}_{Treatment} - \frac{OP\ Therms}{Household}_{Control}\right) \times \#\ Accounts_{Treatment}$$

Where,

$$\frac{OP\ Therms}{Household}_{Treatment} = Other\ program\ Therms\ per\ household\ in\ the\ treatment\ group$$

$$\frac{OP\ Therms}{Household}_{Control} = Other\ program\ Therms\ per\ household\ in\ the\ control\ group$$

$$\#\ Accounts_{Treatment} = Total\ accounts\ in\ the\ treatment\ group$$

The double counted savings, whether positive or negative, were subtracted from a cohort's gross savings estimates from the regression analysis to get total verified persistence savings.

Often, this difference is not statistically significant at the 95% level. Nevertheless, it is standard practice to deduct double counted savings from the estimated savings for a behavioral program.

The following section details our methodology for removing double counted savings for downstream programs.

4.2.6.1 Downstream Programs

Downstream programs traditionally track installed measures at the customer level. This information usually contains available unique customer IDs, customer names, and customer addresses, which are easily correlated with behavioral program data. For downstream measures, NW Natural provided customer-level tracking data with energy savings from other programs NW Natural offers to customers in the behavioral program.

The following steps were taken to estimate behavioral program savings from downstream program uplift:

1. Match the behavioral program treatment and control group customers to the utility energy efficiency program tracking data using customer identifiers,
2. Calculate the savings per treatment group subject from efficiency uplift as the difference between treatment and control groups in average efficiency program savings per subject; and,
3. Multiply that difference by the number of treatment group subjects.

The Evaluators summarized and removed program uplift for each cohort and treatment status for each of the other residential program offerings.

4.2.7 ATTRITION ANALYSIS

The number of treatment and control households in the program can be affected by either move-outs or opt-outs (known collectively as ‘attrition’). If a household’s final bill was the end of the evaluated post-period, it was considered a move out and bills occurring after moveout were removed from the analysis. The Evaluators reported the cumulative level of both treatment and control move outs over the program life by monthly period, cohort, and treatment/control status for each program year. This information can be useful for NW Natural for the potential need for future wave expansions for the pilot.

5 IMPACT EVALUATION RESULTS

This section provides the results of each portion of the impact evaluation. The Evaluators calculated the percent savings per home by dividing the average annual energy savings estimated in the treatment group by the average annual energy consumption from the control group for each program year. That value is then adjusted for uplift from downstream measures. The program-level savings were calculated by multiplying the average annual household impact estimate by the number of active program participants in the treatment group and after removing double counted savings, by program year.

Program savings summarized in Table 3-1 and Table 3-2 are discussed in detail in the following sections.

Table 3-1: Behavioral Program Savings Summary

Cohort	Annual Savings Per Home (Therms/year)	5% CI Annual Savings Per Home (Therms/year)	95% CI Annual Savings Per Home (Therms/year)	Annual Adjusted Savings Per Home[5] (Therms/year)	Total Program Verified Savings (Therms)
WA	4.51	3.73	5.30	4.40	197,373

Table 3-2: Behavioral Program Savings by Month

Cohort	Month	HDD	Unadjusted Savings Per Customer (Therms)
WA	Jan 2024	814	0.68
	Feb 2024	634	0.54
	Mar 2024	560	0.50
	Apr 2024	423	0.40
	May 2024	310	0.33
	June 2024	128	0.20
	Jul 2024	21	0.13
	Aug 2024	33	0.14
	Sep 2024	88	0.17
	Oct 2024	334	0.35
	Nov 2024	552	0.49
	Dec 2024	686	0.59
	Total	**4,583**	**4.51**

[5] These savings are adjusted to remove double counted savings caused by Behavioral program induced Uplift. Uplift increases participation in other Energy Efficiency programs for Behavioral program treatment customers relative to Behavioral program control customers.

5.1 Data Preparation and Cleaning

The Evaluators prepared and cleaned billing data provided by NW Natural and Bidgely prior to running regressions. The following table represents the unique number of customers in the treatment group and the control group throughout the billing cleaning stages.

Table 3-3 Treatment and Control Customers After Restrictions

Cohort	Restriction Detail	Treatment Customers	Control Customers
WA	Start	48,060	13,910
	Keep first wave assignment	48,060	13,910
	After removing bills that occur after inactive date	48,048	13,908
	Remove outliers (>17 Therms/day)	48,048	13,908
	After removing bills that occur before pre-period	48,048	13,908
	Restrict to pre-period and post-period in program year	44,834	12,982
	Restrict to customers with at least 9 months pre and 6 months post	44,834	12,982

The Evaluators conducted calendarization adjustments for each monthly bill. The resulting dataset contained adjusted monthly bill reads with associated consumption and bill duration for each month the customer remained active.

After data preparation and cleaning, the Evaluators performed validity testing for the cohort. The details of this step are provided in the next section.

5.2 Validity Testing Results

After billing preparation and cleaning, the remaining customers were tested for statistically significant differences in usage between the treatment and control groups for each of the 17 pre-period months between June 2022 and October 2023. As shown in the tables below, all waves had valid control groups.

Table 3-4 details differences and statistical significance between each wave's treatment and control groups for each of the 12 months in the pre-period.

Table 3-4 T-Test Results, WA

Pre-Period Month	Treatment Group Average Daily Usage (Therms/day)	Control Group Average Daily Usage (Therms/day)	Average Daily Usage Difference (Therms/day)	P-value	Statistically Significant Difference
Jun-22	0.64	0.64	0.00	0.55	-
Jul-22	0.57	0.57	0.00	0.76	-
Aug-22	0.52	0.52	0.00	0.80	-
Sep-22	0.57	0.57	0.00	0.87	-
Oct-22	1.35	1.35	0.00	0.93	-
Nov-22	3.23	3.23	0.00	0.98	-
Dec-22	3.90	3.90	0.00	0.94	-
Jan-23	3.61	3.61	0.00	0.95	-
Feb-23	3.72	3.72	0.00	1.00	-
Mar-23	3.21	3.21	0.00	0.93	-
Apr-23	2.13	2.13	0.00	0.92	-
May-23	0.94	0.94	0.00	0.94	-
Jun-23	0.66	0.67	-0.01	0.65	-
Jul-23	0.55	0.55	0.00	0.71	-
Aug-23	0.53	0.52	0.01	0.73	-
Sep-23	0.65	0.65	0.00	0.81	-
Oct-23	1.36	1.36	0.00	0.91	-

5.3 Uplift Analysis Results

Participants in both the treatment and control groups participate in other NW Natural energy efficiency programs. The double counted savings, defined in the methodology, whether positive or negative, are subtracted from the wave's gross savings estimates from the regression analysis to get total verified savings. This section summarizes the results of the double counting analysis for downstream programs.

NW Natural delivered tracking data for the residential programs included in the double counting analysis, including the New Homes Program, Existing Single-Family Program, Existing Multifamily Washington Program, and Products Program.

The Evaluators identified and summarized the average treatment customer, average control customer, and average incremental savings attributed to the residential programs.

Table 3-5 displays the verified double-counted savings to be subtracted from the treatment group's annual program savings for PY2024.

Table 3-5: Double-Counted Savings in Residential Programs

Cohort	Average Treatment Household Daily Savings (Therms/year)	Average Control Household Daily Savings (Therms/year)	Average Uplift Household Daily Savings (Therms/year)	Treatment Customers	Program Uplift Savings	Program Uplift % of Annual Savings
WA	1.37	1.26	0.11	44,834	4,870	2%

PY2024 displays a total of 4,870 Therms in double-counted savings. The uplift double counting values are subtracted from the regression model results.

5.4 Linear Regression Modeling Results

This section details the regression results of the evaluated cohort using its original RCT control group.

Table 3-6 displays the annual Therms savings per treatment customer prior to any double counting adjustments. The savings are positive and statistically significant at the 90 percent level.

Table 3-6: WA Cohort Annual Savings per Household

Cohort	Model	Program Year	Estimate	5% CI	95% CI
WA	PPR	PY2024	4.51	3.73	5.30

Table 3-7 displays the complete list of regression coefficients, including all covariate interactions, for PY2024 for the selected PPR model.

Table 3-7: WA Cohort PY2024 PPR Regression Results

Coefficient	Estimate	Std Error	P-Value	5% CI	95% CI
Intercept	0.946	0.02	0.00	0.91	0.98
Treatment	-0.004	0.00	0.11	-0.01	0.00
Feb	-0.264	0.01	0.00	-0.28	-0.25
Mar	-0.297	0.01	0.00	-0.31	-0.28
Apr	-0.476	0.01	0.00	-0.49	-0.46
May	-0.466	0.01	0.00	-0.49	-0.44
Jun	-0.692	0.02	0.00	-0.72	-0.66
Jul	-0.861	0.02	0.00	-0.89	-0.83
Aug	-0.867	0.02	0.00	-0.90	-0.83
Sep	-0.779	0.02	0.00	-0.81	-0.75
Oct	-0.144	0.01	0.00	-0.17	-0.12
Nov	-0.256	0.01	0.00	-0.27	-0.24
Dec	-0.185	0.01	0.00	-0.20	-0.17
Pre-period Usage	0.951	0.00	0.00	0.95	0.95
HDD	-0.025	0.00	0.00	-0.03	-0.02
Pre-period Feb Usage	-0.139	0.00	0.00	-0.14	-0.14
Pre-period Mar Usage	-0.254	0.00	0.00	-0.26	-0.25
Pre-period Apr Usage	-0.229	0.00	0.00	-0.23	-0.23
Pre-period May Usage	0.007	0.00	0.11	0.00	0.01
Pre-period Jun Usage	-0.066	0.01	0.00	-0.07	-0.06
Pre-period Jul Usage	-0.106	0.01	0.00	-0.12	-0.10
Pre-period Aug Usage	-0.018	0.01	0.00	-0.03	-0.01
Pre-period Sep Usage	-0.019	0.01	0.00	-0.03	-0.01
Pre-period Oct Usage	-0.322	0.00	0.00	-0.33	-0.32
Pre-period Nov Usage	-0.182	0.00	0.00	-0.19	-0.18
Pre-period Dec Usage	-0.183	0.00	0.00	-0.19	-0.18
Treatment × HDD	-0.000687	0.00	0.00	0.00	0.00

The Evaluators ran 2 different regression models and selected the best fitting PPR model. The PPR model was a good fit, as seen by the Adjusted R-squared in Table 3-8.

Table 3-8: WA Cohort PPR Model Fit

Cohort	Model	Adjusted R2	F-Statistic	Number of Observations	Number of Treatment Customers
WA	PPR	0.906	254,260	685,874	44,834

The ex-post gross gas savings of the Behavioral program for WA are summarized below. The number of customers used to calculate total ex-post gas savings is the number of treatment customers in the post-period.

Table 3-9: WA Gross Annual Gas Savings, PY2024

Annual Unadjusted Savings Per Home (Therms/yr)	5% CI Annual Unadjusted Savings Per Home (Therms/yr)	95% CI Annual Unadjusted Savings Per Home (Therms/yr)	Annual Double Counted Savings Per Home (Therms/yr)	Annual Adjusted Savings Per Home (Therms/yr)	Annual Control Group Usage Per Home (Therms/yr)	Annual Percent Savings Per Home
4.51	3.73	5.30	0.11	4.40	668.76	0.66%

The Behavioral program displayed 0.66 percent of annual household savings for PY2024. The average annual household savings for treated customers in WA was 4.40 Therms in PY2024. Household savings estimates were extrapolated using the number of treatment customers active in the post-period. The Evaluator found the cohort to display 197,270 Therms in savings for the PY2024 evaluation period. In addition, the 90 percent confidence interval for adjusted annual savings after the double count adjustment is displayed below.

Table 3-10: Total Gross Annual Gas Savings, PY2024

Cohort	Annual Adjusted Savings Per Home (Therms/yr)	Number of Treatment Customers	Total Program Verified Savings (Therms)	5% CI Total Program Verified Savings (Therms)	95% CI Total Program Verified Savings (Therms)
WA	4.40	44,834	197,270	162,272	232,597

5.4.1 DIFFERENCE-IN-DIFFERENCE MODEL RESULTS

The Evaluators ran a difference-in-difference regression model in addition to the PPR model discussed above. This model was not used to extrapolate savings due to the PPR model's higher Adjusted R-squared value compared to that of the difference-in-difference model displayed in Table 3-13. Nevertheless, Table 3-11 provides the estimated annual savings per treatment customer prior to any double counting adjustments.

Table 3-11: Difference-in-Difference Model Annual Savings per Household

Cohort	Program Year	Estimate	5% CI	95% CI
WA	PY2024	4.34	2.13	6.56

Table 3-12 displays the complete list of regression coefficients, including all covariate interactions, for PY2024 for the difference-in-difference model.

Table 3-12: Difference-in-Difference Regression Results

Coefficient	Estimate	Std Error	P Value	5% CI	95% CI
(Intercept)	0.288	0.00	0.00	0.283	0.293
Treatment	0.000	0.00	0.93	-0.005	0.006
Post	-0.063	0.01	0.00	-0.072	-0.055
HDD	0.129	0.00	0.00	0.129	0.130
Treatment × Post	-0.003	0.01	0.60	-0.013	0.007
Treatment × HDD	0.000	0.00	0.68	0.000	0.000
Post × HDD	-0.001	0.00	0.00	-0.002	-0.001
Treatment × Post × HDD	-0.001	0.00	0.09	-0.001	0.000

Table 3-13: WA Cohort Difference-in-Difference Model Fit

Cohort	Model	Adjusted R2	F Statistic	Number of Observations	Number of Treatment Customers
WA	Difference-in-difference	0.608	368,044	1,664,251	44,834

5.4.2 PPR MODEL RESULTS (Q1/Q2 PY2024 VERSUS Q3/Q4 PY2024)

Table 3-14 displays PPR model results when the post-period regression data is restricted to the first half of PY2024 and the second half of PY2024, and regressions are run separately for each post-period interval. The purpose of this split is to explore whether estimated savings are higher for the latter half of PY2024. The regression results for each half of PY2024 were extrapolated to a full year of weather data to allow for the treatment effect to be compared under the same weather conditions. Based on the results below, savings do not appear to increase as the 2024 program year progresses.

Table 3-14: PPR Model Annual Savings per Household

Cohort	Post-Period Months Included	Estimate	5% CI	95% CI	P-Value	Adjusted R2
PPR Model	Jan 2024-Jun 2024	4.69	3.48	5.90	0.00	0.91
PPR Model	Jul 2024-Dec 2024	4.67	3.49	5.86	0.00	0.89

5.5 Attrition Analysis Results

Table 3-15 summarizes the moveout rates for both the treatment group and control group.

Table 3-15: Customer moveouts for Treatment and Control Groups

Cohort	Treatment or Control Group	Treatment Customers Start PY	Treatment Customers End PY	Moveouts	Moveout Percent
WA	Treatment	47,225	44,408	2,817	5.97%
	Control	13,659	12,783	876	6.41%

6 CONCLUSIONS AND RECOMMENDATIONS

The following section details the Evaluators' conclusions and recommendations for the Behavioral program.

Conclusion: Behavioral Program verified annual savings of 197,373 Therms for PY2024 are positive and statistically significant at the 90% level for the Washington cohort.

- The evaluated WA cohort had a valid control group which suggests that the creation of the original RCT cohort by the implementer was done in accordance with industry standards.
- The evaluated cohort displayed average annual gas savings of 0.66 percent of annual billed use in PY2024. Typical behavioral programs display average annual gas savings between 0.25 percent and 2 percent. This is the first program year for the WA cohort, and behavioral program savings often increase in later program years.
- Downstream and upstream double counted savings were 4,870 Therms for PY2024. The double counted savings were removed from the estimated savings from the regression results. The double counted savings represent two percent of program savings before double counting, therefore, the impact on final program savings was insignificant in percentage terms. The observed double counted savings is expected, as Uplift's percentage of program savings is typically between 1 percent and 3 percent.
- The annual attrition rate in PY2024 is roughly 6 percent for the WA cohort for both the treatment and control groups.

Recommendation: Save and store historical billing data for all customers in each wave to ensure future analyses will have one year of billing data prior to the RCT start date for each customer, as well as complete billing data after the intervention.

Conclusion*:* The post-period was defined as 12 months and a measure life was not defined for the program.

Recommendation: Assume a 1-year measure life for ongoing Behavioral programs or change the cohorts each year to claim a longer measure life for savings.

Appendix D: Low-Income Impact Evaluation

EM&V REPORT: NW NATURAL 2010-2022 LOW-INCOME ENERGY EFFICIENCY PROGRAMS

SUBMITTED TO:

NW NATURAL

SUBMITTED BY:

ADM ASSOCIATES, INC.

SUBMITTED DATE:

JANUARY 10, 2025

ADM

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This evaluation was conducted with regular coordination with staff at NW Natural, who provided quick feedback and turnaround to the requests of the evaluation team as well as open and forthright insights into the operations of their programs.

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Contents

Executive Summary

This report is a summary of the impact and process evaluations for both of NW Natural's Low-Income Energy Efficiency programs: the Oregon Low-Income Energy Efficiency Program (OLIEE) and the Washington Low-Income Energy Efficiency Program (WALIEE). These Low-Income energy efficiency programs are designed to support housing stabilization for Low-Income Oregon and Washington NW Natural customers by providing energy bill payment assistance and weatherization services to effectively reduce energy costs and improve health.

NW Natural has requested separate impact analyses and evaluations conducted for the Low-Income energy efficiency programs every four years, since the last impact evaluation report in 2010. Therefore, ADM Associates, Inc. (herein referred to as the "Evaluators") have evaluated the following evaluation periods, by program:

Table 1-1: OLIEE and WALIEE Evaluation Periods

Program	Program Years	Impact Evaluation	Process Evaluation
OLIEE	PY2010-PY2013	✓	
	PY2014-PY2017PY2014-PY2017	✓	
	PY2018-PY2022	✓	✓
WALIEE	PY2010-PY2013	✓	
	PY2014-PY2017PY2014-PY2017	✓	
	PY2018-PY2022	✓	✓

Verified Savings and Process Findings

The Evaluators' analysis yields two estimates of gross savings for each project: an expected gross Therms savings estimates (as reported in the project documentation and program tracking system) and the verified net Therms savings estimates developed through our verification and evaluation procedures. Realization rates for each program are found by taking the ratio of these values. In addition to these impact estimates, the Evaluators conducted process evaluations resulting in several conclusions and recommendations. Lastly, cost-effectiveness testing was performed to estimate net program cost and benefits.

Oregon Low-Income Energy Efficiency Program (OLIEE)

Below, are expected and verified savings for each evaluated program year of the OLIEE program, conclusions and recommendations based on the process evaluations, and cost-effectiveness results from the same periods.

OLLIE Impact Results

Table 1-2 and Table 1-3 shows expected and verified savings by program year and program evaluation period for the OLIEE program. The Evaluators note that the first two evaluation periods cover 4 program years each, while the last evaluation period covers 5 program years. For example, evaluation period PY2010-PY2013 includes program years 2010, 2011, 2012, and 2013. The year of the project completion date was used to define a project's program year.

Table 1-2: Verified Impact Savings by Program Year, OLIEE

Program Year	Number of Participant Homes	Average Number of Installed Measures	Expected Therms Saved	Verified Therms Saved	Realization Rate	Total Incentives and Agency Costs ($)
2010	561	3.2	219,489	52,224	24%	3,448,712
2011	332	3.1	96,895	30,906	32%	2,223,775
2012	268	3.5	76,989	24,948	32%	2,738,388
2013	149	3.3	35,682	13,871	39%	1,024,954
2014	189	3.4	50,778	20,673	41%	1,430,164
2015	182	3.3	42,701	19,907	47%	1,533,943
2016	248	4.0	53,697	27,126	51%	1,970,200
2017	287	4.1	69,094	31,392	45%	2,605,351
2018	295	4.2	97,583	35,046	36%	3,128,583
2019	262	3.9	79,394	31,125	39%	2,738,720
2020	248	3.4	66,745	29,462	44%	2,105,700
2021	176	3.8	55,348	20,909	38%	2,164,725
2022	189	3.8	57,521	22,453	39%	2,916,969
Total	**3,386**	**3.6**	**1,001,916**	**360,042**	**36%**	**30,030,184**

Table 1-3: Verified Impact Savings by Program Evaluation Period, OLIEE

Program Evaluation Period	Evaluation Period Homes	Average Number of Installed Measures	Expected Therms Saved	Verified Therms Saved	Realization Rate	Total Incentives and Agency Costs ($)
PY2010-PY2013	1,310	3.3	429,055	121,949	28%	9,435,829
PY2014-PY2017	906	3.8	216,270	99,098	46%	7,539,658
PY2018-PY2022	1,170	3.9	356,591	138,995	39%	13,054,697
Total	**3,386**	**3.6**	**1,001,916**	**360,042**	**36%**	**30,030,184**

Verified savings from 2010 to 2022 for the program are 360,042 Therms, 36 percent of Expected Savings. One reason for the low realization rate was due to the Expected Therms savings provided in the project tracking data. The Evaluators observed that total Expected Therms savings was high because savings in the project tracking data were not uniquely calculated for each project associated with a customer and reflected cumulative savings across multiple projects. Program costs were also affected by the same issue. However, the Evaluators were not able to obtain the number of projects associated with the Expected Therms savings and program costs and therefore could not provide adjustments to reflect project-level values. The Evaluators noted this issue applied to all program years and program evaluation periods.

In addition, the Evaluators requested measure-level savings from NW Natural to determine how Expected Therms savings were being calculated for the program, however, this data was not available. This prevented the Evaluators from recreating project-level savings to determine whether there were any issues with the calculations of project-level savings in the project tracking data.

OLLIE Cost-Effectiveness Results

The Evaluators estimated cost-effectiveness for the most recent evaluation periods (PY2014-PY2017 and PY2018-PY2022). The results of cost-effectiveness testing showed the program was cost-effective for the TRC, which is the primary cost test for NW Natural energy efficiency programs.

The participant cost test (PCT) is N/A because participants did not incur any costs from the program and were provided the benefits of the program free of charge. As with most Low-Income programs, the UCT and RIM are lower because the utility assumes the full cost of measure installation and equipment.

Table 1-4: Cost-Effectiveness Testing Results OLLIE, PY2014-PY2017

Evaluation Period	TRC	UCT	RIM	PCT	SCT
PY2014-PY2017	2.08	0.25	0.20	N/A	2.34
Overall	**2.08**	**0.25**	**0.20**	**N/A**	**2.34**

Table 1-5: Cost-Effectiveness Testing Results OLLIE, PY2018-PY2022

Evaluation Period	TRC	UCT	RIM	PCT	SCT
PY2018-PY2022	2.31	0.23	0.19	N/A	2.60
Overall	**2.31**	**0.23**	**0.19**	**N/A**	**2.60**

Washington Low-Income Energy Efficiency Program (WALIEE)

Below, are expected and verified savings for each evaluated program year of the WALIEE program, conclusions and recommendations based on the process evaluations and cost-effectiveness results from the same periods.

WALIEE Impact Results

Table 1-6 and Table 1-7 shows expected and verified savings by program year and program evaluation period for the WALIEE program.

Table 1-6: Verified Impact Savings by Program Year, WALIEE

Program Year	Number of Participant Homes	Average Number of Installed Measures	Expected Therms Saved	Verified Therms Saved	Realization Rate	Total Incentives and Agency Costs ($)
2010	16	3.4	6,393	2,598	41%	122,685
2011	11	2.9	3,634	1,786	49%	99,938
2012	8	3.5	2,517	1,299	52%	53,447
2013	20	3.5	7,684	3,248	42%	148,111
2014	10	2.8	3,050	1,624	53%	89,045
2015	9	3.2	3,219	1,462	45%	88,833
2016	17	3.5	6,409	2,761	43%	182,308
2017	13	2.9	6,148	2,111	34%	312,530
2018	16	3.7	7,605	2,598	34%	216,246

2019	22	4.4	20,214	3,573	18%	347,843
2020	8	2.1	1,136	1,299	114%	27,854
2021	14	2.5	3,598	2,273	63%	84,683
2022	11	2.6	703	1,786	254%	71,938
Total	**175**	**3.3**	**72,310**	**28,418**	**39%**	**1,845,461**

Table 1-7: Verified Savings by Program Evaluation Period, WALIEE

Program Evaluation Period	Evaluation Period Homes	Average Number of Installed Measures	Expected Therms Saved	Verified Therms Saved	Realization Rate	Total Incentives and Agency Costs ($)
PY2010-PY2013	55	3.3	20,228	8,931	44%	424,181
PY2014-PY2017	49	3.1	18,826	7,958	42%	672,716
PY2018-PY2022	71	3.3	33,256	11,529	35%	748,564
Total	**175**	**3.3**	**72,310**	**28,418**	**39%**	**1,845,461**

Verified savings from 2010 to 2022 for the program are 28,418 Therms, 39 percent of Expected Savings.

One reason for the low realization rate was due to the Expected Therms savings provided in the project tracking data. The Evaluators observed that the sum of total Expected Therms savings was high because savings in the project tracking data were not uniquely calculated for each project associated with a customer and reflected cumulative savings across multiple projects. Program costs were also affected by the same issue. However, the Evaluators were not able to obtain the number of projects associated with the Expected Therms savings and program costs and therefore could not adjust them to reflect project-level values.

In addition, the Evaluators requested measure-level savings from NW Natural to determine how Expected Therms savings were being calculated for the program, however, this data was not available. This prevented the Evaluators from recreating project-level savings to determine whether there were any issues with the calculations of project-level savings in the project tracking data.

WALIEE Cost-Effectiveness Results

The Evaluators estimated cost-effectiveness for the most recent evaluation periods (PY2014-PY2017 and PY2018-PY2022). The results of cost-effectiveness testing showed the program was cost-effective for the TRC, which is the primary cost test for NW Natural energy efficiency programs.

The participant cost test (PCT) is N/A because participants did not incur any costs from the program and were provided the benefits of the program free of charge. As with most Low-Income programs, the UCT and RIM are lower because the utility assumes the full cost of measure installation and equipment.

Table 1-8: Cost-Effectiveness Testing Results WALLIE, Evaluation Period PY2014-PY2017

Evaluation Period	TRC	UCT	RIM	PCT	SCT
PY2014-PY2017	1.37	0.23	0.19	N/A	1.57
Overall	**1.37**	**0.23**	**0.19**	**N/A**	**1.57**

Table 1-9: Cost-Effectiveness Testing Results WALLIE, Evaluation Period PY2018-PY2022

Evaluation Period	TRC	UCT	RIM	PCT	SCT
PY2018-PY2022	2.08	0.33	0.25	N/A	2.38
Overall	**2.08**	**0.33**	**0.25**	**N/A**	**2.38**

Conclusions and Recommendations

The following section details the Evaluators' conclusions and recommendations for the Low-Income programs.

Conclusion 1: NW Natural's Low-Income program utilizes lenient qualification criteria and provides comprehensive measure coverage. Stakeholders from across the interview groups – program staff, CAP Agency and CBO staff, and trade allies – remarked on NW Natural's comprehensive measure coverage and willingness to expand eligibility for services they can provide. Not only did NW Natural modify the qualification criteria from 200% Federal Poverty Level (FPL) to 80% area median income (AMI) in response to requests by the CAP Agency, but they also expanded health and safety qualifying measures, allowing for more holistic coverage and home updates for customers. CAP agency and CBO staff noted that NW Natural's program has some of the most lenient and flexible qualification criteria – as compared to other similar programs – and participating trade allies indicated that the measures covered are thorough. Furthermore, the program passed the TRC, showing that the program is assisting customers cost-effectively.

Conclusion 2: Most participants and eligible non-participants participate in the CAP Agencies and CBO energy related bill assistance programs. Waitlist times for the program vary across agencies. One CBO representative explained that they avoid waitlists by making their program invite-only, while other CBO representatives and CAP agency staff indicated their wait list times range from a few months to over a year.

Conclusion 3: Non-participants respondents explained that the cost of equipment upgrades was the main factor preventing them from engaging in this type of program, suggesting awareness of NW Natural's assistance for Low-Income is limited and many eligible customers do not realize they may qualify for free weatherization and heating equipment updates.

Recommendation 1: Although wait lists for some of the weatherization and HVAC programs can be lengthy, CAP agency and CBO staff should continue to enroll existing clients into this program to ensure comprehensive energy assistance, as more than half of all non-participant respondents expressed interest in making energy efficient improvements to their home.

Conclusion 4: Workforce development issues limit program expansion. Some CAP Agency representatives explained that workforce issues are their largest barrier to increased engagement. These representatives indicated that funds are available to help more customers, but they struggle to find qualified contractors. Representatives from across the CAP agencies and CBOs remarked that their existing auditors and contractors have been involved in the weatherization business for many years, but that they are concerned about the future longevity of the program due to the lack of new contractors and auditors. One CAP agency representative mentioned an internship program offered by Oregon Training Institute as a possible solution to this issue but noted the state needs more contractors.

Recommendation 2: NW Natural should consider partnering with the Oregon Training Institute and other similar organizations to help offer more workforce development and training opportunities for future contractors and trade allies.

Conclusion 5: CBO representatives underscored the importance of leveraging existing relationships in communities when promoting the program.

Recommendation 3: NW Natural can continue to strengthen their program by expanding their presence in the communities they serve through attendance at and sponsorship of community events. One of the CBO representatives also noted that having a formal contract and master services agreement has also been very helpful in ensuring the program remains funded.

Conclusion 6: Satisfaction across stakeholder groups – CAP agency and CBO staff, contractors, and participants – was high. Interview respondents highlighted NW Natural's communicativeness and willingness to answer questions, while most survey respondents indicated they would recommend the program to others and that they believe NW Natural is a very or extremely trustworthy source of information regarding energy savings in the home.

Conclusion 7: Reported program costs and Expected Therms savings in program tracking data was not unique for each project associated with a customer. A primary reason for the low realization rate was due to the Expected Therms savings provided in the project tracking data. The Evaluators observed that total Expected Therms savings were high because savings in the project tracking data were not uniquely calculated for each project associated with a customer and reflected cumulative savings across multiple projects. Program costs were also affected by the same issue.

Recommendation 4: NW Natural should require implementers to report costs and expected savings uniquely for each project associated with a customer to ensure accurate accounting of expected savings and cost data utilized in cost-effectiveness testing.

Conclusion 8: Incomplete or missing project documentation for sampled projects that were part of document-based verification. For OLIEE, the Evaluators found 25 percent of projects had incomplete, missing, duplicate, or other project documentation issues. For WALIEE, the Evaluators found most projects, 91%, had incomplete, missing, duplicate, or other project documentation issues.

Recommendation 5: NW Natural should collect all application forms, supporting customer or contractor invoices, certificates, project installation photos, and any other associated project-level documents specific to each program for every project.

Conclusion 9: Project documentation for sampled projects from documentation-based verification were missing measure specifications. The Evaluators found that many specifications were missing from the project documentation such as insulation square footage[1], window/door quantities, and model information for furnaces and water heaters. Measures such as furnace tune-ups and direct vent space heaters did not provide any specification information. Furthermore, there were additional measures in the documentation that were not accounted for in the project tracking data for many customers.

Recommendation 6: NW Natural should collect additional measure information including installed square footage, baseline measure efficiency, retrofit measure efficiency, measure quantities, and make/model information for each project to aid verification efforts. In addition, all measures should be listed in the project tracking data for each project.

Conclusion 10: Measure-level savings for each program were not available from the implementer or NW Natural. The Evaluators requested measure-level savings from NW Natural to determine how Expected Therms savings were being calculated for the program, however, this data was not available.

Recommendation 7: NW Natural should maintain a list of measures for the program with measure-level savings. This will allow for the recreation of Expected Therms savings by Evaluators for each project to determine if savings are being properly calculated and to identify potential issues with project data.

Conclusion 11: The Evaluators found statistically significant savings for each program evaluation period. For OLIEE, the Evaluators estimated savings between 93.1 and 118.8 Therms annually per customer across all cohorts. This results in percent savings between 16.6 percent and 19.2 percent

[1] Insulation square footage differs from whole-home square footage and refers to the square footage of the installed insulation from insulation measures such as ceiling/attic insulation, floor insulation, and wall insulation.

compared to the counterfactual control customers. For WALIEE, the Evaluators note that the savings are near the upper end of the expected savings range normally observed for a weatherization program. The Evaluators estimated savings of 162.39 Therms annually per customer, a 25.2 percent savings compared to the control customers.

Recommendation 8: The billing analysis results show the program is effectively reducing energy consumption for program participants. NW Natural should keep targeting the same customers and continue with the same general program implementation used in prior program years to continue providing positive energy savings to their customers.

Conclusion 12: The Evaluators found statistically significant reductions in arrears for program participants. The Evaluators estimated a $213 reduction in annual arrears for participants compared to the counterfactual control customers. The Evaluators found no statistically significant changes in disconnects or disconnection notices for participants.

Recommendation 9: The Evaluators recommend NW Natural include a Non-Energy Benefit adder of $21.3 per participant for arrears when performing cost-effectiveness testing for the program.

Report Organization

From this point, the remaining report chapters include:

Chapter 2: General Evaluation Methodology

Chapter 3: OLIEE Program Impact Results

Chapter 4: WALIEE Program Impact Results

Chapter 5: Low-Income Program Process Results

Appendix A: Cost-Effectiveness Testing

Appendix B: Unit Energy Savings

Appendix C: Data Collection Recommendations

Appendix D: Survey Collections Instruments

General Evaluation Methodology

The Evaluators completed an impact evaluation for each of the programs summarized in the Executive Summary. Our activities estimate and verify annual savings, conduct cost-effectiveness testing and provide energy savings from a single source, aimed at providing guidance for continuous program improvement.

Glossary of Terminology

As a first step to detailing the evaluation methodologies, the Evaluators have provided a glossary of terms to follow:

Deemed Savings – An estimate of an energy savings outcome (gross savings) for a single unit of an installed energy efficiency measure. This estimate (a) has been developed from data sources and analytical methods that are widely accepted for the measure and purpose and (b) are applicable to the situation being evaluated.

Measure – Energy saving device, unit, or service.

UES – Unit Energy Savings are a single unitized savings estimate (e.g., savings per motor, savings per hp) that represent an average or weighted average of similar savings measures. UES measures are also known as deemed savings measures.

Expected Savings – Calculated savings used for program and portfolio planning purposes.

Verified Savings – Savings estimates after the updated unit-level savings values have been updated and energy impact evaluation has been completed, integrating results from billing analyses and appropriate RTF UES values.

Gross Savings – The change in energy consumption directly resulting from program-related actions taken by participants in an efficiency program, regardless of why they participated.

Free Rider – A program participant who would have implemented the program measure or practice in absence of the program.

Net-To-Gross – A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts.

Net Savings – The change in energy consumption directly resulting from program-related actions taken by participants in an efficiency program, with adjustments to remove savings due to free ridership.

Non-Energy Benefits – Quantifiable impacts produced by program measures outside of energy savings (comfort, health and safety, reduced alternative fuel, etc.).

Non-Energy Impacts – Quantifiable impacts in energy efficiency beyond the energy savings gained from installing energy efficient measures (reduced cost for operation and maintenance of equipment, reduced environmental and safety costs, etc.).

Pre-Period – The period prior to installation of energy efficient equipment or upgrade, typically set to equal a one-year period.

Post-Period – The period after installation of energy efficient equipment or upgrade, typically set to equal a one-year period.

HDD – Heating degree days (HDD) are a measurement used to estimate the amount of energy required to heat a building or space during a specific period, typically a day or a month. It is primarily used in regions with cold climates to assess the demand for heating and to evaluate energy consumption.

TMY – A Typical Meteorological Year (TMY) is a synthesized set of weather data representing the long-term climatic conditions for a specific location. It is constructed using historical weather data collected over several years (e.g., 15 or 30 years), typically obtained from weather stations in the vicinity of the location of interest. The purpose of a TMY is to provide a standardized dataset that represents the "typical" weather conditions for a particular location. The Evaluators utilized the latest available years of data from TMYx (2009-2023) to reflect the most recent historical weather data available.

Dummy Variable - A dummy variable, also known as an indicator variable or binary variable, is a categorical variable that takes on one of two values to represent the presence or absence of a characteristic or condition. It is commonly used in statistical analysis and regression modeling to represent qualitative factors and typically takes the value of 0 or 1, where 0 represents the absence or reference category, and 1 represents the presence or alternative category.

Impact Evaluation Approach

The Evaluators used the following approaches to calculate energy impact defined by the International Performance Measurement and Verification Protocols (IPMVP) and the Uniform Methods Project (UMP):

Database review

Simple verification (document-based, survey-based)

Deemed savings

Whole building billing analysis (IPMVP Option C)

The table below summarizes the impact evaluation activities by program.

Table 2-10: Impact Evaluation Activities by Program

Program	Program Evaluation Period	Database Review	Document Verification	Survey Verification	Gas Impact Methodology
OLIEE	PY2010-PY2013	✓	✓	✓	IPMVP Option C: Billing analysis with comparison group
	PY2014-PY2017	✓	✓	✓	IPMVP Option C: Billing analysis with comparison group

Program	Program Evaluation Period	Database Review	Document Verification	Survey Verification	Gas Impact Methodology
	PY2018-PY2022	✓	✓	✓	IPMVP Option C: Billing analysis with comparison group
WALIEE	PY2010-PY2013	✓	✓	✓	IPMVP Option C: Billing analysis with comparison group*
	PY2014-PY2017	✓	✓	✓	IPMVP Option C: Billing analysis with comparison group*
	PY2018-PY2022	✓	✓	✓	IPMVP Option C: Billing analysis with comparison group*

*Due to low participation in the WALIEE Program, the Evaluators conducted a billing analysis for all 12 years combined, with weather-adjusted annual household savings extrapolated to actual 4-year evaluation period participants.

The Evaluators employed two major approaches to determining net savings for NW Natural's Low-Income programs:

A *Deemed Savings* approach involves using stipulated savings for energy conservation measures for which savings values are well-known and documented. These prescriptive savings may also require an adjustment for certain measures, such as incorporation of in-service rates, in which an adjustment is made to reflect the proportion of measures verified to be installed on-site.

A *Billing Analysis* approach involves estimating energy savings by applying a linear regression to measured participant energy consumption utility meter billing data. Billing analyses may also include billing data from nonparticipant customers. This approach does not require primary data collection or adjustments such as in-service rates, as the observed energy reductions inherently incorporate these adjustments. This approach aligns with the IPMVP Option C.

Impact Evaluation Framework

The Evaluators approach the impact evaluation was from the frame of mind that final M&V methodologies should be determined by approaches feasible with the given historical data and participation rates as well as the relative contribution of a given program to the overall energy efficiency impacts. The Evaluators reviewed relevant information on infrastructure, framework, and guidelines set out for EM&V work in several guidebook documents that have been published over the past several years. These include the following:

Northwest Regional Technical Forum (RTF)

Technical reference manuals, such as the Energy Trust of Oregon or NW Natural Technical Reference Manuals

National Renewable Energy Laboratory (NREL), United States Department of Energy (DOE) The Uniform Methods Project (UMP): Methods for Determining Energy Efficiency Savings for Specific Measures, April 2013[2]

International Performance Measurement and Verification Protocol (IPMVP) maintained by the Efficiency Valuation Organization (EVO) with sponsorship by the U.S. Department of Energy (DOE)[3]

The Evaluators kept data collection instruments, calculation spreadsheets, and survey data available for NW Natural records.

Data Utilized

For each of the programs and measures evaluated, the Evaluators obtained the following datasets from NW Natural:

Program tracking data for each of the measures offered through OLIEE and WALIEE, completed between July 1, 2010 and June 30, 2022

Participant monthly gas consumption data between July 1, 2009 and December 31, 2023

Nonparticipant monthly gas consumption data between July 1, 2009 and December 31, 2023

Project-level documentation, including application forms, equipment specification documents, equipment invoices, and project installation documents

Customer contact information

Trade ally contact information and number of projects completed in each program year

Community Action Partnership staff contact information

NW Natural staff contact information

Typical Meteorological Year (TMY) X weather data (2018-2023), TMY3 weather data, and NOAA weather data for each evaluated program year.

To evaluate each of the measures, the Evaluators conducted primary data collection activities. The Evaluators performed the following data collection activities:

Stratified sampling plan that achieves 90/10 confidence precision goals

Surveyed a random subset of participating customers to collect information pertinent to validating associated energy impacts

[2] Notably, The Uniform Methods Project (UMP) includes the following chapters authored by the Evaluators. Chapter 9 (Metering Cross- Cutting Protocols) was authored by Dan Mort and Chapter 15 (Commercial New Construction Protocol) was Authored by Steven Keates.
[3] Core Concepts: International Measurement and Verification Protocol. EVO 100000 – 1:2016, October 2016.

Further details of measure-specific sampling plans and data collection activities are described in Section 2.2.4 below.

The Evaluators used the data provided by NW Natural to first conduct a database review for each measure. The Evaluators then conducted a detailed document review for a sample of projects. The purpose and methods for these activities are described in the subsections below.

Database Review

At the outset of the Low-Income energy efficiency program impact and process evaluations, the Evaluators reviewed Low-Income program databases to ensure that they conform to industry standards, have a standardized and documented data dictionary, and adequately track key data relevant to the implementation and evaluation of the program.

The Evaluators recognize that failure to develop and maintain a sufficient tracking system can add significantly to the cost of implementation, monitoring, verification and evaluation; reduce confidence in results; and increase the variance in estimates of savings. Therefore, we make this a high priority in our iterative review of each program over the course of all evaluation periods of interest.

Document-based Verification

In addition to an aggregate tracking database review, the Evaluators requested rebate and project documentation for a randomly selected subset of participating Low-Income customers in each of the programs, for each evaluation period of interest. Documentation for this task included application forms, supporting customer or contractor invoices, AHRI certificates, project installation photos, and any other associated project-level documents specific to each program.

For each project sampled, the Evaluators verified quantities and efficiencies for upgraded equipment or weatherization specifications according to the invoices and associated applications and documents. Deviations between tracking data and project documentation values were noted and summarized.

The Evaluators developed a sampling plan that aimed to achieve a sampling precision of ±10% at 90% statistical confidence – or “90/10 precision” – for net realized savings estimates at the measure category level for all significant measures during document-based verification for each program.

That is, at each state and program level, statistical precision and confidence will meet 90/10 precision at minimum. In a generalized form, simple random samples for a statistically infinite population are developed as follows:

$$n = \left(\frac{1.645 * cv}{rp}\right)^2$$

Where,

n = sample size

1.645 = *z* score reflecting 90% confidence for a two-tailed distribution

cv = Coefficient of Variation, defined as standard deviation / mean

rp = Required Precision, 10% for 90/10 sampling

Standard practice is to assume a CV of .50 for homogenous programs (such as residential programs). In this instance, the required sample for 90/10 is $(1.645 * .5 / .1)^2 = 68$. For programs with limited participation, this sample is adjusted as follows:

$$n_0 = \frac{n}{1 + \frac{n}{N}}$$

Where,

n_0 = Finite-population adjusted sample

n = Sample for a statistically infinite population

N = total population size

Thus, for a population of 400, the required sample to meet ±10% precision at 90% confidence is:

$n_0 = 68 / [1+ 68/400)] = 58.12$, rounding up to 59.

The Evaluators utilized the sample sizes for each program summarized in Table 2-2 for the OLIEE and WALIEE programs, by evaluation period.

Table 2-11: Document-Based Verification Sample Design for OLIEE and WALIEE

Program	Program Evaluation Period	Population of Homes	Sample of Homes	Precision
OLIEE	PY2010-PY2013	1,310	64	90% ± 9.93%
	PY2014-PY2017	906	63	90% ± 9.95%
	PY2018-PY2022	981	63	90% ± 9.98%
	Total	**3,197**	**192**	**90% ± 5.75%**
WALIEE	PY2010-PY2013	55	30	90% ± 9.86%
	PY2014-PY2017	49	28	90% ± 9.73%
	PY2018-PY2022	60	32	90% ± 9.83%
	Total	**164**	**84**	**90% ± 5.67%**

Survey-Based Verification

This section describes the Evaluators' general methodology for conducting survey-based verification for NW Natural's Low-Income energy efficiency programs. In addition to the document-based verification summarized above, the Evaluators verified tracking data by surveying a sample of participant customer households.

A sample of participants were surveyed to confirm that the measure was installed and is still currently operational and whether the measure was a new construction, early retirement, or replace-on-burnout,

if applicable to the measure. Although survey verification is not necessary for weatherization measures, which are unlikely to be removed, uninstalled, or fail, this verification effort is especially relevant for the non-weatherization measures, such as gas furnaces and gas tank water heaters.

This survey effort helped Evaluators develop in-service rates, or the percentage of projects in which the measure is still currently operational and installed. This in-service rate acts as an adjustment to deemed savings estimates to reflect verified savings in the service territory. The selected sample participants were offered a $10 gift card incentive to participate in the verification survey.

The Evaluators combined survey-based verification efforts with the survey-based process evaluation efforts to maximize the quality and quantity of data collected toward multiple deliverables while minimizing customer response fatigue. The findings from these activities will primarily serve the impact evaluation to:

Verify measure was installed

Verify measure is functional

Because this evaluation effort also includes a process evaluation of the Low-Income energy efficiency programs, the Evaluators included these verification questions in the overall process evaluation efforts, further defined in Section 2.3.3.

These verification surveys also serve an additional purpose: when billing analysis is infeasible, this simple verification will help the Evaluators more accurately estimate measure-level impacts using engineering algorithms while accounting for unforeseen new equipment failures or removed installations.

The Evaluators utilized the sample sizes for survey-based verification efforts in Table 2-3. The most recent program year was utilized for participant surveys to ensure participants would be able to recall their experiences with the program. Due to the low participation in the programs in 2023 and the similarity of measure offerings, the OLIEE and WALIEE programs were combined for this survey effort.

Table 2-12: Survey-Based Verification Sample Design for OLIEE and WALIEE

Program	Program Year	Population of Homes	Target Survey Response Goal	Assumed Response Rate	Target Responses
OLIEE /WALIEE	2023	186	50	10-15%	17-28

Impact Evaluation Methods

In this section, the Evaluators define the approach used to complete impact evaluation activities for NW Natural's Low-Income programs. As previously mentioned, the Evaluators define two major approaches to determining net savings for the OLIEE and WALIEE programs:

Deemed Savings (for Deemed Measure List)

Whole Building Billing Analysis (IPMVP Option C)

In the following sections, we summarize the general guidelines and activities the Evaluators will follow to conduct each of the above analyses.

Impact Analysis with Billing Analysis

ADM evaluated NW Natural's Low-Income energy efficiency programs utilizing a billing analysis. The Evaluators explored multiple regression analyses using monthly gas consumption data. These model specifications are recommended in the National Renewable Energy Laboratory (NREL) Uniform Methods Project (UMP)[4].

The regression models included a counterfactual control group, which is useful for estimating net energy savings – that is, participating homes are compared against nonparticipating homes. The nonparticipating homes represent the observed market baseline and equipment efficiencies demonstrated by NW Natural's actual customer base. Therefore, results from this analysis utilizing a counterfactual control group represent net energy savings. NW Natural could not identify non-participant homes that were also Low-Income customers, however, having any control group greatly improves the impact estimates.

The Evaluators understood that NW Natural wished to evaluate verified savings at the measure level for the most recent program year for both OLIEE and WALIEE. Therefore, as part of the billing data steps, the Evaluators explored analyses in which the households utilized in the analysis consist only of homes that have isolated measure participation to estimate measure-level savings within the most recent program year. This ensures that natural gas furnace savings are not included in the estimation of attic insulation projects, and vice versa. For all other program evaluation periods, the Evaluators explored whole-home billing analyses with participants of any measure included in the analysis.

Regression Model Specifications

The Evaluators explored two different regression models to estimate energy savings for the study: 1) Difference-in-Difference (D-n-D) with Fixed Effects; 2) Post Period Regression (PPR). The model specifications and required data are summarized in the table below.

For the purposes of this proposal, the "treatment group" is the group of participants that have received participated in the OLIEE or WALIEE Programs, while the "control group" is a group of non-participant residential homes displaying similar energy usage behaviors as the treatment group.

To create a matched control group of Low-Income households, the Evaluators utilized customers that did not participate in the Low-Income programs. Working with NW Natural, the Evaluators determined that NW Natural does not track Low-Income households in its customer database and that exact matching participants and non-participants on Low-Income status was not possible. However, utilizing a control group with similar energy usage characteristics after Propensity Score Matching greatly improves impact estimates. While bias can be introduced if economic, social, or other factors cause differential impacts to energy consumption for Low-Income households compared to non-participant

[4] https://energy.gov/sites/prod/files/2015/02/f19/UMPChapter17-residential-behavior.pdf

households, this is an issue regardless of whether Low-Income households are exactly matched to other Low-Income households.

Table 2-13: Regression Models

Model	General Regression Equation	Quasi-Experimental Control Group
Difference-in-Difference with Fixed Effects (D-n-D)	Average Daily Usage ~ (Customer, Month, Post, Treatment, HDD, Post*Treatment, HDD*Post*Treatment	✓
Post-Program Regression (PPR)	Average Daily Usage ~ (Month, Treatment, Average Pre-period Spring Usage, Average Pre-period Winter Usage, Average Pre-period Summer Usage, Average Pre-period Fall Usage, HDD, HDD*Treatment, Month*Average Pre-period Spring Usage, Month*Average Pre-period Winter Usage, Month*Average Pre-period Summer Usage, Month*Average Pre-period Fall Usage)	✓

Each of the models has different methods of controlling for household-level differences and provide reliable estimates of savings, assuming participation is sufficient. In addition, all models have interaction terms between treatment and weather (or month) to provide seasonal and overall estimates of energy savings. The Evaluators provide further details for each model below:

The D-n-D with Fixed Effects regression model controls for individual differences through a variable that is equal to the customer's average daily energy use that has been averaged across the pre- and post-treatment period.

The PPR model uses post-period data, with lagged energy use for the same calendar month of the pre-program period, integrating the underlying logic is that systematic differences between participants and controls will be reflected in differences in their past energy use, which is highly correlated with their current energy use.

As part of regression modeling, the Evaluators' data scientists checked variable correlations and performed sensitivity testing. The Evaluators then extrapolated energy savings estimates to the weather data observed over the 4-year evaluation periods, for each program.

The selected regression model was based on model fit, the ability of the model to control for autocorrelation, and model performance during sensitivity testing.

Billing Data Preparation

The Evaluators prepared consumption data for each cohort's billing analysis tasks. The following steps were taken to prepare consumption data for each cohort analysis:

Identify homes in the consumption data that were participants in OLIEE and WALIEE, separately;

Exclude homes without sufficient pre- and post- consumption data (at least 9 months of valid consumption data in each period);

Exclude homes with consumption data indicating it is an outlier[5];

Identify and remove duplicate records,

Calendarize the gas billing data;

Identify customers with isolated measure installs;

We report the number of retained customers in the analysis groups, after each step to identify issues or possible sources of bias.

Propensity Score Matching

To estimate the most reliable and unbiased results, it is ideal to estimate program impacts with a randomized control trial (RCT). However, RCTs are not viable due to the design of many programs, including NW Natural's Low-Income energy efficiency programs, which would require programs to turn away a portion of customers that sign up for the program, to use as a control group. There exists, however, methods for producing a control group via quasi-experimental methods. In this section the Evaluator further describes the steps required for cleaning billing data and creation of the counterfactual control groups.

The Evaluators created a statistically similar control group using propensity score matching (PSM), a method that allows us to find the most similar household based on the customers' billed consumption trends in the pre-period and verified with statistical difference testing. The Evaluators utilized this method because it is likely to have more meaningful results than a treatment-only analysis. The integration of a control group in a regression analysis allows the Evaluators to eliminate bias and outside influence as much as possible. Some examples of outside variables that a control group can sufficiently control for are changes in economies and markets, large-scale social changes, or impacts from weather-related anomalies such as flooding or hurricanes. A propensity score is a metric that summarizes several dimensions of household characteristics into a single metric that can be used to group similar households.

To create a post-hoc control group, the Evaluators compiled billing data for a control group to compare against treatment households via quasi-experimental methods. The Evaluators utilized billing data from customers that have not participated in NW Natural's Low-Income energy efficiency programs or in other energy efficiency programs. With this information, the Evaluators created a statistically valid control group via PSM, matching on seasonal pre-period usage.

Although quasi-experimental methods may result in selection bias (the possibility that those who are chosen in the treatment group are systematically different from those who did not participate), the PSM

[5] The Evaluators examined data for outliers using multiple accepted identification techniques: simple Z-scores, Bonferroni Outlier Test, Grubbs Test for Outliers (G-test), or others as appropriate. The Evaluator aims to remove error readings rather than remove high and low users, as these subgroups contribute real behaviors to the average savings estimate.

method ensures to the extent feasible that average characteristics of the treatment and comparison groups are similar, resulting in minimal bias within a non-RCT design.

Validity Testing

The Evaluators checked that the quasi-experimental control group was statistically similar to the treatment group by conducting the Welch's Two-Sample T-test for each month in the pre-period between each group. If the post-hoc control group passes the t-test for most pre-period months (at least 9 of the 12 pre-period months), and the groups are validly balanced, the Evaluators continued with the regression models summarized in the sections above. This validity test is conducted to ensure that control and treatment groups are not statistically different at the 90% confidence interval. This method was completed separately for each of the 4-year evaluation periods, for both OLIEE and WALIEE.

Deemed Savings (Unit Energy Savings) Approach

The Evaluators created a deemed measure list based on current program offerings. The Evaluators completed the validation for specific measures across each program using applicable Regional Technical Forum (RTF) baseline assumptions, where applicable. Verified impact estimates depend on variables included but not limited to the following:

Verify household type (SF, MF, MH, etc.)

Verify space heating system type

Verify cooling system type

Verify water heating system type

Verify heating and cooling zone

Verify equipment sizing (tonnage, gallons)

Using this method, the Evaluators estimated deemed verified savings using region-based research conducted by the utilities in the region. The goal was to ensure that the proper measure unit savings are utilized in verified savings.

In addition, the Evaluators utilized the most recent 4-year evaluation of whole home projects, as well as the most recent year annual measure-level savings of offered individual measures to create an expected unit energy savings value for each of the measures offered through the program. These deemed measure values were weather adjusted for a typical meteorological year (TMYx) to assess future-looking expected program savings for each OLIEE and WALIEE.

The Evaluators reviewed program application documents for a sample of incented measures to verify the tracking data accurately represents the original program documents. This sample met 90/10 precision goals. The Evaluators ensured the home installed measures that meet or exceed program efficiency standards.

The Evaluators applied verification adjustments to these UES values if deviations were found between tracking data and document-based verification, and if in-service rates deviated from 100% reported in survey responses.

Process Approach and Methodology

The Evaluators conducted a thorough process evaluation of the OLIEE and WALIEE Programs to identify program strengths as well as areas for potential program improvement in each of the respective NW Natural programs. As detailed below, the process evaluation addressed the objectives identified in the RFP and covered all elements of a successful program, including design, staffing, marketing, implementation, delivery, and customer response. An important part of this evaluation was to identify market barriers that impede the program's reach into all parts of NW Natural's Low-Income residential Oregon and Washington markets. The Evaluators evaluated the most recent program year of activities, as customers from earlier program years may not remember the upgrades completed in years prior.

The following subsections present overviews of our approach to process evaluation, followed by information on how we identified and answered important research questions, our data collection approaches, interview and survey implementation, and the timing and cadence of process evaluation activities.

Process Evaluation Overview

Our approach to process evaluation for the NW Natural Low-Income energy efficiency programs addressed the overall effectiveness of program activities in overcoming barriers and provides strategic guidance to assist program improvement. Data collection activities provided information on the effectiveness of program processes and procedures, including how well the program works with key stakeholders to optimize program operations. To this end, the Evaluators:

Reviewed program documentation and interviewed program and implementer staff to understand program goals, rules, and processes - including any coordination with delivery of gas utility programs - as well as to reveal any issues or concerns to be investigated through other process evaluation data collection;

Interviewed applicable market actors about their experiences with the program to shed light on the effectiveness of program processes, the communication between NW Natural and the CAP Agencies it partners with, its implementers, marketing activities, customer decision-making, and participation barriers;

Surveyed program participants about their experiences, including satisfaction with the program, and their decision-making process; and

Surveyed nonparticipants to reveal the level of program awareness and identify barriers to participation.

From the information obtained from the process evaluation, the Evaluators identified what the programs are doing well and what factors may be preventing the programs from achieving their goals or doing so more cost-effectively. The information will help NW Natural and the CAP Agencies better understand the impact evaluation results and make related management decisions.

The Evaluators used process evaluation best practices, which include:

Allocating process evaluation resources based on each program's contribution to overall energy savings; evidence of evaluation need (e.g., failure to meet savings goals, feedback from CAP Agencies, or unsolicited feedback from customers or trade allies); changes in program design or implementation; and the recency with which these programs had a detailed process evaluation.

Designing all data collection instruments to address specific research questions, ensuring that all needed information is collected, and none is collected that will not or cannot be used.

Presenting the process evaluations results clearly and efficiently, identifying how each interview or survey finding addresses a specific research question. NW Natural will not have to sort through lengthy descriptions of every survey response trying to figure out the meaning of the results.

Providing meaningful high-level conclusions, which will form the basis for clear, actionable recommendations for process improvements where identified.

Where possible, we sought to achieve the standard level of 90% confidence of 10% precision (90/10) for participant surveys. We note, however, NW Natural's recognition that such a level of confidence and precision is not always feasible, particularly in programs with relatively small participant populations. In the case of market actors, such as contractors, retailers, and distributors, the choice of data collection approach was driven by the size of the relevant market actor population and the nature of the data to be collected.

Table 2-5 summarizes our preliminary proposed data collection approaches for each program, for the most recent program year. We discuss sample size and confidence/precision issues in more detail in the sections below.

Table 2-14: Summary of Process Evaluation Sources, by Program

Programs	Document & Data Review	Staff / Implementers	Trade Allies	CAP Agencies	Participants	Non-participants
OLIEE	Reviewed all program documentation, (e.g., marketing plans and materials, implementation plans, applications) and project files.	Individual or group interviews with program and implementer staff of each program in each state	Omnibus online survey and/or phone interviews	Omnibus online survey and/or phone interviews	Multi-mode surveys, targeting 90/10 confidence/ precision	Multi-mode survey, with 90/10 confidence/ precision
WALIEE						

Identifying and Answering the Important Process Questions

The Evaluators used the various information sources – program documentation review, staff, CAP Agency staff, and implementer interviews, and customer surveys – to provide convergent information to address the identified research questions. We made maximally effective use of each source by identifying which sources provide the most applicable information to each question, as shown in Table 2-6. For example, while program and implementer staff interviews did not touch on most or all research questions, we relied more heavily on feedback from CAP Agency staff, participants, and nonparticipants to assess customer service and market barriers. Market actors and program participants provided

important input into most questions relating to program implementation but were not major sources of information regarding management tools or cost management. Our assessment of nonparticipants' awareness of the program offerings and reasons for nonparticipation provide important information relating to program marketing, participation information, measure offerings, health and safety issues, and customer service as well as participation barriers.

Table 2-15: Data Sources to Answer Process Evaluation Research Questions

Process Evaluation Research Question	Document and Data	Staff	CAP Agencies	Market Actors	Participants	Nonparticipants
Are programs run per design and efficiently/effectively?	✓	✓	✓	✓	✓	
Is staffing/organization sufficient and appropriate?		✓	✓			
Is customer service of high quality, timely, and effective?			✓	✓	✓	✓
Are marketing plans implemented per design and effective?	✓	✓		✓	✓	✓
Are quality assurance procedures appropriate and effective?	✓	✓	✓	✓	✓	
Are management and implementation tools appropriate and effective?	✓	✓	✓			
Are implementation contractors running programs effectively?		✓	✓	✓	✓	
Are program materials effective and complete?	✓	✓	✓	✓	✓	✓
Are costs managed properly and efficiently?	✓	✓	✓			
Are contractors effectively capturing appropriate opportunities and ensuring comprehensive services?		✓	✓	✓	✓	
Are rebates/incentives appropriate for meeting program goals?		✓	✓	✓	✓	✓
What are the market barriers that impede program reach?			✓	✓	✓	✓
Is the program reaching the intended hard to reach customers?		✓	✓	✓		✓
Are there remaining customers that qualify for the program have issues or barriers with participating in these programs?		✓	✓	✓		✓

The key to delivering a truly valuable process evaluation is refining and specifying the research questions by reviewing previous evaluation findings and thoughtfully interviewing program and implementer staff. Another aspect of identifying and answering the important questions is understanding what is and is not meaningful in evaluation results. In preparing reports, the Evaluators sought to prioritize the

dissemination of information that can lead to material and beneficial changes or insight for NW Natural Low-Income program managers and stakeholder groups.

Data Collection Approaches: Core Programs

The following provides details on the process evaluation data collection approaches utilized.

Document and Data Review

The Evaluators reviewed available program documents, including program manuals, program logic models, contractor training materials, CAP Agency marketing materials and plans, and application forms to better understand how the program operates and to inform the evaluation design. The review also served as process evaluation input, by helping us identify opportunities for program improvement, such as potentially overlooked marketing channels or tactics, or opportunities to streamline or expand application forms to collect needed data.

Reviewing NW Natural's Low-Income energy efficiency program logic models helped ensure our understanding of each program's objectives and how the program's activities are expected to achieve those objectives.

We also reviewed project tracking data, which is a valuable resource for understanding how the program is performing and the market response. A review of the data system also verified that the data is sufficient and complete enough to support program management and evaluation.

Program and Implementer Interviews

We conducted in-depth interviews (IDIs) with program management staff to fill out our understanding of program design, goals, processes, and marketing strategies; to assess communication and coordination between NW Natural and its implementers, CAP agencies, and hard-to-reach communities; to get NW Natural's input on its implementer performance; to gain insight into quality control and assurance processes; to identify challenges that the programs have encountered and how those challenges have been addressed; and to clarify evaluation goals and research questions. Because these programs revolve around hard to reach (HTR) customers and their unique barriers to program participation and unique energy needs, the Evaluators developed a unique battery of questions for this target demographic that focuses on energy burden, program satisfaction, program communication methods, and additional energy needs. This is prioritized as a part of the evaluation objectives due to the equity objectives in the Clean Energy Transformation Act (CETA), present in the state of Washington. Senior evaluation team members conducted the IDIs using semi-structured interview guides (see Instrument Development, below).

Market Actor, Participant, and Nonparticipant Surveys

We conducted telephone or web surveys with market actors, program participants, and nonparticipants. We anticipated conducting surveys as telephone, web, or mixed-phone/web surveys due to the demographics of these programs' customers.

The selection of survey type depended on the nature of the target audience, the anticipated challenges in reaching customers by various methods, and the nature of the information to be collected. Decreasing response rates to residential phone surveys over the past several years have made web surveys a more cost-effective approach for residential target audiences. Response to web surveys also have declined in recent years; thus, we considered and recommended other modes as appropriate.

Market Actors

In the case of market actors, such as contractors, retailers, and distributors, the choice of data collection approach was driven by the size of the relevant market actor population and the nature of the data to be collected.

Participants

The Evaluators conducted a survey of Northwest Natural's Low-Income Program participants from program year 2023 to gather feedback about customers' engagement with and experience of the program. The most recent program year was utilized for participant surveys to ensure participants would be able to recall their experiences with the program. Due to the low participation in 2023, participants from OLIEE and WALIEE were combined into a single survey, as shown in Table 2-7.

Table 2-16: Participant Survey Sample

Program	Program Year	Population of Homes	Sample of Homes	Precision
OLIEE/WALIEE	2023	186	35	90% ± 13.9%

Nonparticipants

The Evaluators conducted a nonparticipant survey of likely Low-Income residential customers in both Washington and Oregon, targeting 90/10 confidence/precision. As with participant surveys, we anticipated a mix of online and phone surveys, possibly including mailed recruitments to take the online survey. However, email surveys were performed and exceeded the required survey target.

Interview and Survey Implementation

The Evaluators conducted all interviews and surveys using in-house resources. In the sections below, we detail our interview and survey instrument development and implementation.

Instrument Development

We developed all interview guides and survey instruments to address research questions identified in the RFP, during project initiation, or in staff and implementer interviews and with a mind to the analysis to be performed. Table 2-6 documents the research questions specific to each data source, which guided the process for developing each instrument. This ensured that the research questions for each instrument were vetted and discussed with NW Natural.

We provided a crosswalk between the vetted research questions and each interview or survey item when we submitted the draft instruments to NW Natural. This ensured that there is no question or confusion about the purpose of any given item. Providing NW Natural staff with a clear understanding of the purpose of each item in the instrument enabled them to provide focused feedback on those items. We revised each item as needed based on the feedback received.

Survey Programming and Testing

The Evaluators programmed all surveys, both phone and web, using an industry-standard survey platform, Qualtrics. The platform is widely used by professional survey research and evaluation firms and supports web, telephone, and dual-mode survey administration. It offers sophisticated programming features for developing user-friendly interfaces and offers a range of options for response validation and display logic. It also provides controls for preventing duplicate or ineligible submissions and allows the option of completing surveys in multiple sessions. It provides the ability to allow respondents to select the survey language as well as the ability to embed screener questions in email invitations.

We tested each survey to ensure that all questions and responses are included and worded correctly, and all input and display logic works correctly. The program lead assessed the look and feel of the survey (size of font, amount of white space, location of page breaks, and so forth) and provided suggestions for improvement, when needed.

Once each survey was programmed, we carried out a soft launch of a small subsample as a second check to ensure the survey programming was correct as well as to determine whether any questions were not well understood or needed to be revised for any other reason.

Survey Recruitment

We prepared telephone and email recruitment scripts to deploy to participant and nonparticipant customers as a call to action to participate in the survey. These materials included several well-known elements, such as personalizing the message, stating the intended use of the responses and the importance of everyone's response, making a personal appeal, and so forth. They provided the name of the Evaluators evaluation staff contract to answer questions about the survey. We also provided NW Natural contact information to provide *bona fides* or answer questions. Email recruitment also provided a call-in number for customers who wanted to complete the survey by phone.

Survey recruitment was accomplished through multiple modes of recruitment, specifically:

Initial email invitation

Two reminder email invitations, three business days apart

Telephone-based surveys for customers without email addresses

In recruiting for both phone and email surveys, we followed additional protocols to attempt to maximize response rates and reduce customer burden. We carried out multiple recruitment attempts but spaced them to provide adequate opportunity to respond to each one before sending another.

The Evaluators provided $10 incentives for survey completions.

Coordinated Efforts

The Evaluators coordinated efforts with NW Natural staff regarding customer contact and conducted research to minimize the time impact on NW Natural's customers participating in this evaluation. We endeavored to facilitate a strong sense of coordination and collaboration with our clients through multiple avenues, including:

Client review of interim and final work product: We included NW Natural into the review process for recruitment email and telephone messaging, survey instrument development, site-level M&V plans, and interim and final reporting. Messages included contact information for the customer call center, along with contact information for a senior project manager at the Evaluators.

Involved NW Natural staff in the Quality Assurance (QA) process for data collection.

The Evaluators involved NW Natural staff by allowing client staff to participate in and audit telephone surveys, including client to receive a survey and experience it from a program participant's perspective, and other potential methods as the opportunities present themselves.

The Evaluators worked with NW Natural to instruct their call centers on answering customer inquiries regarding the Evaluators' role as the EM&V contractor to ensure transparency and reliability to customers and to preserve NW Natural's customer relations with residential customers. The Evaluators maintained a 'do not contact' list for customers that expressed a desire to be removed from call lists for future EM&V work. For many residential programs, however, maintaining a 'do not contact' list does not compromise the impact evaluation process.

Cost-Effectiveness Testing

The Evaluators calculated each program's cost-effectiveness, avoided energy costs related to infrastructure capacity, commodity and transport/storage, environmental compliance, and risk reduction, and implementation costs for the most recent program year using the Evaluators-developed cost-effectiveness tool. Similar to other Low-Income evaluations completed by the Evaluators in the region, the Evaluators determined the economic performance with the following cost-effectiveness tests:

Total Resource Cost (TRC) test;

Utility Cost Test (UCT);

Participant Cost Test (PCT);

Rate Impact Measure (RIM) test; and

Societal Cost Test (SCT).

Non-Energy Benefits

The Evaluators conducted a literature review to quantify non-energy benefits (NEBs) for Low-Income residential programs with established values where available.

The Evaluators also worked with NW Natural staff to identify a listing of NEIs and NEBs that were of interest for each program. Additionally, the Evaluator recognized there may be additional health and safety benefits for programs that target hard to reach communities. The Evaluators worked with NW Natural to prioritize the identification of such additional NEIs and NEBs for these programs as they are designed and rolled out.

Inputs and methods for cost-effectiveness testing are provided in Appendix A: Cost-Effectiveness Testing.

Disconnections and Arrearages

NW Natural provided information on arrears, service disconnection notices, and service disconnections for participants and non-participant customers during the analysis period (2010-2023). The Evaluators estimated a quantified impact of the program on customers' capability to stay current on their gas bills by comparing arrears and disconnections for participants and non-participants in the pre- and post-periods. The Evaluators utilized matched control customers from the billing analysis to estimate net impacts for arrears and disconnections and to control for factors including differences in payment plans and other household characteristics.

Utilizing the data provided from NW Natural, the Evaluators calculated the following outcomes:

Annual arrearage reduction per participant,

Annual disconnection reduction per participant; and

Annual disconnection notice reduction per participant.

OLIEE Impact Results

Since 2002, the OLIEE program has been offered to provide equitable access to DSM by funding high-efficiency equipment and weatherization measures to Low-Income homes. The program consists of two parts: The Community Action Program (CAP), and the Open Solicitation Program (OSP). OLIEE funding is used to improve the efficiency of NW Natural's Low-Income customers' homes through the installation of high efficiency equipment and weatherization measures. The program is delivered by ten Community Action Agencies (Agencies) within NW Natural's Oregon service territory.

OLIEE program was redesigned from paying prescriptive amounts for the installation of specific measures, to paying for all energy efficiency measures deemed cost-effective when analyzed at the whole-house level. The OLIEE pilot's new "whole house" perspective was adopted in conjunction with a series of annually escalating agency targets.

In the following tables, the Evaluator summarizes the number of historical homes treated through the OLIEE program, as well as expected Therms saved, verified Therms saved, and measure counts.

Table 3-17: OLIEE Program Measure Counts by Evaluation Period

Measure	Count of Measures (PY2010-PY2013)	Count of Measures (PY2014-PY2017)	Count of Measures (PY2018-PY2022)
Ceiling Insulation	723	519	631
Direct Vent Space Heater	86	2	5
Duct Insulation	463	363	505
Duct Sealing	588	449	616
Faucet Aerators	1	0	9
Floor Insulation	679	500	619
Furnace Tune-Up	83	47	66
HE Water Heater	20	15	22
HE Windows	236	115	179
High Efficiency Furnace	292	450	710
Hot Water Pipe Insulation	3	5	12
Infiltration	708	625	779
Thermal Doors	53	14	51
Wall Insulation	327	304	318

Totals	**4,262**	**3,408**	**4,522**

Table 3-18: Verified Impact Savings by Program Year, OLIEE

Program Year	Number of Participant Homes	Average Number of Installed Measures	Expected Therms Saved	Verified Therms Saved	Realization Rate	Total Incentives and Agency Costs ($)
2010	561	3.2	219,489	52,224	24%	3,448,712
2011	332	3.1	96,895	30,906	32%	2,223,775
2012	268	3.5	76,989	24,948	32%	2,738,388
2013	149	3.3	35,682	13,871	39%	1,024,954
2014	189	3.4	50,778	20,673	41%	1,430,164
2015	182	3.3	42,701	19,907	47%	1,533,943
2016	248	4.0	53,697	27,126	51%	1,970,200
2017	287	4.1	69,094	31,392	45%	2,605,351
2018	295	4.2	97,583	35,046	36%	3,128,583
2019	262	3.9	79,394	31,125	39%	2,738,720
2020	248	3.4	66,745	29,462	44%	2,105,700
2021	176	3.8	55,348	20,909	38%	2,164,725
2022	189	3.8	57,521	22,453	39%	2,916,969
Total	**3,386**	**3.6**	**1,001,916**	**360,042**	**36%**	**30,030,184**

Table 3-19: Verified Impact Savings by Program Evaluation Period, OLIEE

Program Evaluation Period	Evaluation Period Homes	Average Number of Installed Measures	Expected Therms Saved	Verified Therms Saved	Realization Rate	Total Incentives and Agency Costs ($)
PY2010-PY2013	1,310	3.3	429,055	121,949	28%	9,435,829

PY2014-PY2017	906	3.8	216,270	99,098	46%	7,539,658
PY2018-PY2022	1,170	3.9	356,591	138,995	39%	13,054,697
Total	**3,386**	**3.6**	**1,001,916**	**360,042**	**36%**	**30,030,184**

Database Review and Document-based Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the OLIEE Program. The Evaluators selected a subset of rebate applications to cross-verify tracking data inputs, summarized in Section 2.2.4.

The Evaluators reviewed each measure's number of units, efficiency, square footage, capacity and insulation values where available. During the review, the Evaluators found there were some projects with incomplete, missing, duplicate, or other documentation issues, as summarized in Table 3-4.

Table 3-20: Project Documentation Summary, OLIEE

Project Documentation Status	Number of Participants	% of Participants
Complete	146	75%
Incomplete	18	9%
Missing	25	13%
Duplicate	2	1%
Other	3	2%
Total	**194**	**100%**

The Evaluators found 18 customers that had project documentation, but this documentation lacked the necessary information to successfully complete the database review. For example, many of these customers provided the NW Natural CAP Program Improvement Analysis Report but they did not provide an invoice for the work that was performed or information on the efficiency of the equipment or upgrade completed. Therefore, the Evaluators could not confirm these measures were upgraded.

The Evaluators did not receive any project documentation for 25 out of 194 customers. Lastly, there were three customers with documentation that did not match the names and addresses in the provided tracking data and one customer with two duplicate rows but different account/request ID numbers.

The Evaluators also found that many specifications were missing from the documentation such as insulation square footage, window/door quantities, and model information for furnaces and water

heaters. Measures such as furnace tune-ups and direct vent space heaters did not provide any specification information. The Evaluators were not able to perform database review for these measures. Furthermore, there were additional measures in the documentation that were not accounted for in the raw tracking data for many customers. The required information necessary to complete verification activities and proper expected savings calculations are measure installed square footage values for insulation measures, measure quantities for window/door measures, and make/model information for Water Heaters/Furnaces to calculate precise savings.

Verification Survey

The Evaluators randomly selected a subset of participant customers to survey for simple verification of installed measures. The Evaluators included questions such as:

Was the program equipment detailed in program records received?

Are the received program measures installed and working?

The responses to this verification survey were used to calculate ISRs for the measures offered in the OLIEE Program. All survey respondents for each measure described equipment as currently functioning, leading to a 100% ISR.

Billing Analysis

The results of the billing analysis for the OLIEE Program are provided in this section. The methodology for the billing analysis is provided in Section 2.2.7.

Table 3-5 provides the number of customers and the evaluation period for the whole-home billing analyses performed for OLIEE.

Table 3-21: Whole-home Cohorts, OLIEE

Level of Analysis	Evaluation Period	Number of Participants
Whole-Home	PY2010-PY2013[6]	1,310
	PY2014-PY2017	902
	PY2018-PY2022	1,255

Table 3-6 displays customer counts for customers considered for measure-level billing analysis and identifies measures that met the requirements for a billing analysis. The Evaluators require at least 75 isolated projects in order to be sufficient for billing analysis estimates, depending on expected magnitude of measure savings. Of the eleven single measures installed, only the High Efficiency Furnace measure had sufficient participation to move forward with a measure-level billing analysis.

[6] Although the earliest cohort initially included 1,310 customers, pre-period billing data was not available, and therefore the evaluation period was modified to 2011-2013, with 2010 set as the pre-period.

Table 3-22: Measures Considered for Billing Analysis, OLIEE Program Evaluation Period PY2018-PY2022

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Isolated-Measure Installations	Sufficient Participation for Billing Analysis
Ceiling Insulation (OR)	✓	4	
Direct Vent Space Heater (OR)	✓	2	
Duct Insulation (OR)	✓	2	
Duct Sealing (OR)	✓	1	
Floor Insulation (OR)	✓	4	
Furnace Tune Up (OR)	✓	1	
HE Water Heater (OR)	✓	1	
HE Windows (OR)	✓	1	
High Efficiency Furnace (OR)	✓	123	✓
Infiltration (OR)	✓	12	
Wall insulation (OR)	✓	7	

The Evaluators were provided with a considerable pool of control customers to draw upon. Before matching treatment and control customers, both the treatment group and pool of control customers were restricted to customers with at least nine months of pre-period and post-period calendarized billing data. Additionally, customers were required to have billing data from all four seasons of the pre-period year. Once these restrictions were satisfied, the Evaluators used nearest neighbor matching with a 1-to-1 matching ratio. Matching with replacement was utilized, which allowed a control customer to be matched with more than one treatment customer. The final number of customers in each the treatment and control group are listed in Table 3-7 and Table 3-8.

The Evaluators performed three tests to determine the success of PSM:

t-test on pre-period usage by month

Joint chi-square test to determine if any covariates are imbalanced

Standardized difference test for each covariate employed in matching

All tests confirmed that PSM performed well for each measure and the Evaluators conducted a linear regression using the matched participant and nonparticipant monthly billing data.

Table 3-23: Treatment Group Counts After Data Restrictions, OLIEE

Cohort	Starting Number of Treatment Customers	Customers with Calendarized Billing Data	Customers with Pre-Period and Post-Period Billing Data	Customers with Sufficient Seasonal Pre-period Data	Customers After PSM Matching
Whole Home (PY2010-PY2013)	1,310	1,298	838	838	834
Whole Home (PY2014-PY2017)	902	899	590	589	587
Whole Home (PY2018-PY2022)	1,255	1,254	752	751	749
High Efficiency Furnace Measure (PY2018-PY2022)	123	123	66	66	66

Table 3-24: Control Group Counts After Data Restrictions, OLIEE

Cohort	Starting Number of Control Customers	Customers with Calendarized Billing Data	Customers with Pre-Period and Post-Period Billing Data	Customers with Sufficient Seasonal Pre-period Data	Customers After PSM Matching
Whole Home (PY2010-PY2013)	14,151	14,151	2,904	2,904	623
Whole Home (PY2014-PY2017)	14,151	14,151	3,457	3,454	504
Whole Home (PY2018-PY2022)	14,151	14,151	4,835	4,835	647
High Efficiency Furnace Measure (PY2018-PY2022)	14,151	14,151	4,834	4,834	63

Table 3-9 provides verified annual Therms savings per customer for each evaluated cohort. Model 2 (PPR) was selected as the final model for all cohorts as it provided the highest adjusted R-squared among the regression models. Regression Model 1 (D-n-D) provided similar estimates of whole-home savings, but with a lower model fit (adjusted R-squared). The Evaluators estimated savings between 93.1

and 118.8 Therms annually per customer across all cohorts. This results in percent savings between 16.6 percent and 19.2 percent compared to the control customers.

Table 3-25: Billing Analysis Results, OLIEE

Cohort	Number of Treatment Customers	Average Number of Installed Measures	Verified Annual Therms Savings per Customer	90% Confidence Interval	Average Annual Therms Usage for Control Customers	Percent Savings of Annual Therms Usage	Adjusted R-Squared
Whole Home (PY2010-PY2013)	834	3.3	93.1	(87.1, 99.1)	559.7	16.6%	0.96
Whole Home (PY2014-PY2017)	587	3.8	109.4	(102.3, 116.5)	587.3	18.6%	0.83
Whole Home (PY2018-PY2022)	749	3.9	118.8	(111.5, 126.1)	652.4	18.2%	0.98
High Efficiency Furnace Measure (PY2018-PY2022)	66	1.0	116.9	(82.8, 151.1)	610.1	19.2%	0.66

Program-Level Results

Table 3-10 and Table 3-11 shows expected and verified savings by program year and program evaluation period for the OLIEE program.

Table 3-26: Verified Impact Savings by Program Year, OLIEE

Program Year	Number of Participant Homes	Average Number of Installed Measures	Expected Therms Saved	Verified Therms Saved	Realization Rate	Total Incentives and Agency Costs ($)
2010	561	3.2	219,489	52,224	24%	3,448,712
2011	332	3.1	96,895	30,906	32%	2,223,775
2012	268	3.5	76,989	24,948	32%	2,738,388
2013	149	3.3	35,682	13,871	39%	1,024,954
2014	189	3.4	50,778	20,673	41%	1,430,164

2015	182	3.3	42,701	19,907	47%	1,533,943
2016	248	4.0	53,697	27,126	51%	1,970,200
2017	287	4.1	69,094	31,392	45%	2,605,351
2018	295	4.2	97,583	35,046	36%	3,128,583
2019	262	3.9	79,394	31,125	39%	2,738,720
2020	248	3.4	66,745	29,462	44%	2,105,700
2021	176	3.8	55,348	20,909	38%	2,164,725
2022	189	3.8	57,521	22,453	39%	2,916,969
Total	**3,386**	**3.6**	**1,001,916**	**360,042**	**36%**	**30,030,184**

Table 3-27: Verified Impact Savings by Program Evaluation Period, OLIEE

Program Evaluation Period	Evaluation Period Homes	Average Number of Installed Measures	Expected Therms Saved	Verified Therms Saved	Realization Rate	Total Incentives and Agency Costs ($)
PY2010-PY2013	1,310	3.3	429,055	121,949	28%	9,435,829
PY2014-PY2017	906	3.8	216,270	99,098	46%	7,539,658
PY2018-PY2022	1,170	3.9	356,591	138,995	39%	13,054,697
Total	**3,386**	**3.6**	**1,001,916**	**360,042**	**36%**	**30,030,184**

Verified savings from 2010 to 2022 for the program are 337,589 Therms, 36% of Expected Savings. Drivers of non-100% realization which are specific to the OLIEE program are:

Verified Therms savings as a percentage of annual usage ranged from 16% to 20% across program evaluation periods; however, expected Therms savings as a percentage of annual usage ranged from 40% to 60%. Therefore, the expected Therms savings per customer are too high for the program, likely due to lack of project-level energy savings estimates in the tracking data. The Evaluators typically see whole-home retrofit savings for Low-Income programs fall between 10% and 20% of annual usage. The Evaluators observed that the expected savings in the tracking data for each customer may have represented savings for multiple projects.

WALIEE Impact Results

In 2009, NW Natural launched a revised Low-Income program identified as WALIEE. Modeled after Oregon's Low-Income CAP program, the WA-LIEE program reimburses administering agencies for installing weatherization measures that are cost-effective when analyzed at the whole-house level. In Washington, two agencies co-administer the program. The program is informed by input from NW Natural's Energy Efficiency Advisory Group (EEAG).

Homes with gas in SW Washington tend to be newer construction with less of a need for weatherization, and only 2% of NW Natural's customers in Washington qualify as Low-Income. Therefore, barriers such as these limit participation and the participation rates for the WALIEE program are lower than the participation rates for OLIEE program.

In the following tables, the Evaluator summarizes the number of historical homes treated through the WALIEE program, as well as expected Therms saved, verified Therms saved, and measure counts.

Table 4-28: WALIEE Program Measure Counts by Evaluation Period

Measure	Count of Measures (PY2010-PY2013)	Count of Measures (PY2014-PY2017)	Count of Measures (PY2018-PY2022)
Ceiling Insulation	43	44	48
Direct Vent Space Heater	1	0	0
Duct Insulation	34	33	46
Duct Sealing	3	1	0
Faucet Aerators	0	0	0
Floor Insulation	22	36	45
Furnace Tune-Up	1	0	21
HE Water Heater	0	0	2
HE Windows	0	0	0
High Efficiency Furnace	7	1	5
Hot Water Pipe Insulation	14	4	17
Infiltration	34	21	43
Thermal Doors	0	0	0
Wall Insulation	25	14	9
Totals	**184**	**154**	**236**

Table 4-29: Verified Impact Savings by Program Year, WALIEE

Program Year	Number of Participant Homes	Average Number of Installed Measures	Expected Therms Saved	Verified Therms Saved	Realization Rate	Total Incentives and Agency Costs ($)
2010	16	3.4	6,393	2,598	41%	122,685
2011	11	2.9	3,634	1,786	49%	99,938
2012	8	3.5	2,517	1,299	52%	53,447
2013	20	3.5	7,684	3,248	42%	148,111
2014	10	2.8	3,050	1,624	53%	89,045
2015	9	3.2	3,219	1,462	45%	88,833
2016	17	3.5	6,409	2,761	43%	182,308
2017	13	2.9	6,148	2,111	34%	312,530
2018	16	3.7	7,605	2,598	34%	216,246
2019	22	4.4	20,214	3,573	18%	347,843
2020	8	2.1	1,136	1,299	114%	27,854
2021	14	2.5	3,598	2,273	63%	84,683
2022	11	2.6	703	1,786	254%	71,938
Total	**175**	**3.3**	**72,310**	**28,418**	**39%**	**1,845,461**

Table 4-30: Verified Savings by Program Evaluation Period, WALIEE

Program Evaluation Period	Evaluation Period Homes	Average Number of Installed Measures	Expected Therms Saved	Verified Therms Saved	Realization Rate	Total Incentives and Agency Costs ($)
PY2010-PY2013	55	3.3	20,228	8,931	44%	424,181

PY2014-PY2017	49	3.1	18,826	7,958	42%	672,716
PY2018-PY2022	71	3.3	33,256	11,529	35%	748,564
Total	**175**	**3.3**	**72,310**	**28,418**	**39%**	**1,845,461**

Database Review and Document-based Verification

Before conducting the impact analysis, the Evaluators conducted a database review for the WALIEE Program. The Evaluators selected a subset of rebate applications to cross-verify tracking data inputs, summarized in Section 2.2.4.

The Evaluators reviewed each measure's number of units, efficiency, square footage, capacity and insulation values where available. During the review, the Evaluators found there were some projects with incomplete, missing, duplicate, or other documentation issues, as summarized in Table 4-4.

Table 4-31: Project Documentation Summary, WALIEE

Project Documentation Status	Number of Participants	% of Participants
Complete	8	9%
Incomplete	77	83%
Missing	7	8%
Duplicate	0	0%
Other	1	1%
Total	**93**	**100%**

The Evaluators found that 77 out of 93 customers had project documentation, but this documentation lacked the necessary information to successfully complete the database review. Many of these customers did not provide an actual invoice for the work that was performed. The customers that did provide invoices were missing critical specification information needed to complete the database review such as square footage values, R-values, and make/model information. Therefore, the Evaluators could not complete the database review for these customers.

The Evaluators also found 7 customers did not have any project documentation and the Evaluators were not able to perform database review for these customers. Lastly, there was one customer with documentation that did not match the name and address in the raw tracking data.

The Evaluators found that the WALIEE program had some of the same data quality issues as the OILEE program. Only 8 of the 93 customers had complete project documentation from which to perform database review. Many specifications were missing from the project documentation such as insulation square footage values, window/door quantities, and model information for furnaces and water heaters. Measures such as furnace tune-ups and direct vent space heaters did not provide any specification information. The Evaluators were not able to perform database review for these measures. Furthermore, there were additional measures in the documentation that were not accounted for in the raw tracking data for many customers. The required information necessary to complete verification activities and proper expected savings calculations are measure installed square footage values for insulation measures, measure quantities for window/door measures, and make/model information for Water Heaters/Furnaces to calculate precise savings.

Verification Survey

The Evaluators randomly selected a subset of participant customers to survey for simple verification of installed measures. The Evaluators included questions such as:

Was the program equipment detailed in program records received?

Are the received program measures installed and working?

The responses to this verification survey were used to calculate ISRs for the measures offered in the WALIEE Program. All survey respondents for each measure described equipment as currently functioning, leading to a 100% ISR.

Billing Analysis

The results of the billing analysis for the WALIEE Program are provided in this section. The methodology for the billing analysis is provided in Section 2.2.7.

Table 4-5 displays customer counts for customers considered for measure-level billing analysis. The Evaluators require at least 75 isolated projects in order to be sufficient for billing analysis estimates, depending on expected magnitude of measure savings. None of the three single measures installed had sufficient participation to move forward with a measure-level billing analysis.

Table 4-32: Measures Considered for Billing Analysis, WALIEE Program Evaluation Period PY2018-PY2022

Measure	Measure Considered for Billing Analysis	Number of Customers w/ Isolated-Measure Installations	Sufficient Participation for Billing Analysis
90% High Efficiency Furn (WA)	✓	1	
Furnace Tune-up (WA)	✓	13	
HE Water Heater (EF=.62) (WA)	✓	1	

The Evaluators were provided with a considerable pool of control customers to draw upon. Before matching treatment and control customers, both the treatment group and pool of control customers were restricted to customers with at least nine months of pre-period and post-period calendarized billing data. Additionally, customers were required to have billing data from all four seasons of the pre-period year. Once these restrictions were satisfied, the Evaluators used nearest neighbor matching with a 1-to-1 matching ratio. Matching with replacement was utilized, which allowed a control customer to be matched with more than one treatment customer. The final number of customers in the treatment and control group are listed in Table 4-6.

The Evaluators performed three tests to determine the success of PSM:

t-test on pre-period usage by month

Joint chi-square test to determine if any covariates are imbalanced

Standardized difference test for each covariate employed in matching

All tests confirmed that PSM performed well for each measure and the Evaluators conducted a linear regression using the matched participant and nonparticipant monthly billing data.

Table 4-7 provides verified annual Therms savings per customer. Model 2 (PPR) was selected as the final model for as it provided the highest adjusted R-squared among the regression models. Regression Model 1 (D-n-D) provided similar estimates of whole-home savings, but with a lower model fit (adjusted R-squared). The Evaluators estimated savings of 162.39 Therms annually per customer, a 25.2 percent savings compared to the control customers.

Table 4-33: Customer Counts After Data Restrictions, WALIEE

Group	Starting Number of Treatment Customers	Customers with Calendarized Billing Data	Customers with Pre-Period and Post-Period Billing Data	Customers with Sufficient Seasonal Pre-period Data	Customers After PSM Matching
Treatment	173	172	49	49	49
Control	14,151	14,151	2,642	2,642	47

Table 4-34: Billing Analysis Results, WALIEE

Treatment Customers	Average Number of Installed Measures	Annual Savings per Customer	90% Confidence Interval	Average Annual Therms Usage for Control Customers	Percent Savings of Annual Therms Usage	Adjusted R-Squared	Model

49	3.3	162.39	(130.81, 193.97)	645.62	25.2%	0.807	PPR

Program-Level Results

Table 4-8 and Table 4-9 shows expected and verified savings by program year and program evaluation period for the WALIEE program.

Table 4-35: Verified Impact Savings by Program Year, WALIEE

Program Year	Number of Participant Homes	Average Number of Installed Measures	Expected Therms Saved	Verified Therms Saved	Realization Rate	Total Incentives and Agency Costs ($)
2010	16	3.4	6,393	2,598	41%	122,685
2011	11	2.9	3,634	1,786	49%	99,938
2012	8	3.5	2,517	1,299	52%	53,447
2013	20	3.5	7,684	3,248	42%	148,111
2014	10	2.8	3,050	1,624	53%	89,045
2015	9	3.2	3,219	1,462	45%	88,833
2016	17	3.5	6,409	2,761	43%	182,308
2017	13	2.9	6,148	2,111	34%	312,530
2018	16	3.7	7,605	2,598	34%	216,246
2019	22	4.4	20,214	3,573	18%	347,843
2020	8	2.1	1,136	1,299	114%	27,854
2021	14	2.5	3,598	2,273	63%	84,683
2022	11	2.6	703	1,786	254%	71,938
Total	**175**	**3.3**	**72,310**	**28,418**	**39%**	**1,845,461**

Table 4-36: Verified Savings by Program Evaluation Period, WALIEE

Program Evaluation Period	Evaluation Period Homes	Average Number of Installed Measures	Expected Therms Saved	Verified Therms Saved	Realization Rate	Total Incentives and Agency Costs ($)
PY2010-PY2013	55	3.3	20,228	8,931	44%	424,181
PY2014-PY2017	49	3.1	18,826	7,958	42%	672,716
PY2018-PY2022	71	3.3	33,256	11,529	35%	748,564
Total	**175**	**3.3**	**72,310**	**28,418**	**39%**	**1,845,461**

Verified savings from 2010 to 2022 for the program are 26,632 Therms, 37% of Expected Savings. Drivers of non-100% realization which are specific to the WALIEE program are:

Verified Therms savings as a percentage of annual usage were 25%; however, expected Therms savings as a percentage of annual usage were 68%. Therefore, the expected Therms savings per customer are too high for the program, likely due to lack of project-level energy savings estimates in the tracking data. The Evaluators typically see whole-home retrofit savings for Low-Income programs fall between 10% and 20% of annual usage. The Evaluators observed that the expected savings in the tracking data for each customer may have represented savings for multiple projects.

Low-Income Program Process Results

Staff Interview

The Evaluators interviewed three NW Natural staff involved in the implementation of the Low-Income programs. Interviewees included the Energy Efficiency portfolio manager, the Low-Income Energy Efficiency program manager, and the Environmental Program Assistant. Staff explained that NW Natural's Low-Income program began in Oregon in 2006 and Washington in 2009. As of the 2024 program year, nine Oregon based CAP agencies, one Washington based CAP agency, and three community-based organizations partner with NW Natural to provide energy efficiency equipment upgrades to NW Natural customers.

Program Design

The Low-Income program provides energy efficient weatherization and heating equipment to qualified customers, as well as health and safety upgrades. Prior to spring 2024 NW Natural capped the health-safety allowances to $2,000 per home, but after spring 2024 NW Natural did away with this cap to provide customers with more services and assistance. The program is funded by public service funds, as well as federal, state, and county specific funding. Staff explained that NW Natural continued to collect public service funds during the COVID-19 pandemic but were not able to update many homes and therefore the program currently has a healthy reserve of funds they are currently working through.

The participating CAP Agencies and community-based organizations complete the housing audits, contract with trade allies to install the upgrades, and submit reimbursement applications on behalf of their clients. Program participants receive all measures free of charge.

Marketing

Promotion of the program is a joint effort between NW Natural, the CAP Agencies, and the community-organizations. Marketing strategies include bill inserts, DIY weatherization kits with program insert, website page, and booths at community events. NW Natural staff explained that depending on the county, the program has varying levels of waitlists so although they are actively promoting the program to all customers, they are cognizant of potential delays in service delivery.

Program Participants

Customers qualify for NW Natural funding if their annual household income is at or below 80% of the area median income (AMI). Prior to the spring of 2024, eligibility was based on annual household income being at or below 200% the federal poverty line, but NW Natural expanded its criteria based off feedback from CAP Agencies and other community representatives.

Most program participants live in single-family homes that they own. Although renters are eligible for the program, the landlord needs to agree to participate and promise to not raise rent nor evict tenants for a certain period-of-time. Additionally, although the program is open to multi-family apartment

buildings, due to the low proliferation of multi-family apartment buildings with gas heating, few large buildings have participated in the program.

Program Challenges

Staff cited a lack of engaged contractors and staff turnover as the primary barriers to increased program engagement. They explained that some contractors do not consider the projects lucrative due to the payment structure and proposal-based nature of the program. Staff noted a shortage of certified auditors available to assess homes. Additionally, staff explained that the CAP Agencies rely on a variety of funding sources and often prioritize customers based on need and funding availability.

Staff also explained that program engagement varies by county, indicating some counties have more capacity and staff to implement the program than other counties. For example, staff noted that Multnomah and Washington County can observe up to 80 projects per year, while Linn and Benton counties may observe less than 20 projects.

Program Successes

Despite these challenges, program staff feel optimistic about the Low-Income program moving forward. Recent partnerships and pilot program with local community-based organizations like LatinoBuilt, Oregon Energy Fund, and African American Alliance for Homeownership have enabled NW Natural to expand its program to traditional hard to reach communities as well as expand its services. Additionally, program staff indicated the change in program eligibility requirements opened the program up to more customers and allowed for more assistance.

Moving forward, NW Natural staff want to continue improving the program to better serve the needs of their CAP Agency and community-based organization partners and their customers.

CAP Agency Interview Results

The evaluation team conducted interviews with CAP Agency and community-based organization (CBO) associated with the NW Natural Low-Income program to learn more about how NW Natural works with these partners to deliver residential retrofit services to customers throughout Oregon and SW Washington. In general, these interviews focused on how NW Natural collaborates with these various entities, how these collaborations serve priority populations, and the various partnerships' strengths, weaknesses, and opportunities for improvement.

NW Natural staff provided the Evaluators contact information for representatives from the eleven participating CAP Agencies in Oregon (n=10) and SW Washington (n=1); as well as representatives from three community-based organizations. The Evaluators reached out to each CAP Agency and CBO up to three times via phone and email and invited them to participate in a thirty-minute interview. Seven CAP Agencies and three CBOs responded to interview requests. Table 5-1 outlines which CAP Agencies and CBOs responded to interview requests; Clark County Weatherization (WA), Mid-Willamette Valley

Community Action Agency (OR), and Yamhill Community Action Partnership (OR) did not participate in an interview.

Table 5-37: Interviewed CAP Agencies and CBOs

Organization	Counties served	Type
Clackamas County Weatherization	Clackamas (OR)	CAP Agency
Community Action Organization - Hillsboro	Washington (OR)	CAP Agency
Community Action Team - Astoria (St. Helens)	Clatsop, Columbia (OR)	CAP Agency
Community Services Consortium - Corvallis	Benton, Lincoln, Linn (OR)	CAP Agency
Homes for Good Housing Agency	Lane (OR)	CAP Agency
Multnomah County Community Services Division	Multnomah (OR)	CAP Agency
SW OR Com Action Committee - OR Coast Com Action	Coos (OR)	CAP Agency
Oregon Energy Fund	Multnomah, Washington (OR)	CBO
African American Alliance for Homeownership (AAAH)	Multnomah (OR)	CBO
Latino Built	Multnomah, Clackamas, Washington, Marion, Polk (OR)	CBO

Representatives interviewed tended to be the agencies director or weatherization program manager, and tenures ranged from 2.5 years to 38 years. CAP Agency representatives explained that their agencies have been partnered with NW Natural since the onset of the Low-Income program; the three CBO representatives indicated that their partnerships began about two to three years ago and that these partnerships were part of pilot program aimed at expanding services past CAP Agencies.

Funding Sources & Services Provided

Eight of the CAP agencies and CBOs receive funding from other sources, like Energy Trust of Oregon and LIHEAP, to help fund the weatherization and heating equipment upgrades for their community members. All these agencies explained they braid funding sources to maximize the benefits available to their clients; each funding source has specific rules and regulations, so representatives make sure the funds are being used appropriately. For example, although NW Natural has more lenient income eligibility requirements – 200% area median income rather than 80% federal poverty line – only customers with gas fueled heat sources are eligible for NW Natural funding. In addition to the more lenient income qualifications, respondents indicated that NW Natural's health and safety measure coverage is broader and more comprehensive. They went on to explain that some funding sources are strict about making sure all measures meet a certain level of cost-effectiveness, however NW Natural is

less strict, open to negotiations, and tries to do what needs to be done to improve the health, safety, and energy consumption of customers.

All the representatives indicated that NW Natural does not deny any cost-effective or health and safety related improvement and that the improvements they will deny are ones that are completely aesthetic in nature. Multiple representatives (n=4) cited windows as the most requested, but rejected measure, explaining that although customers desire new windows, the energy calculations often demonstrate that new windows will not drastically reduce or improve energy usage and therefore they are not the best option for the home. Instead, updated insulation and furnaces tend to be the most effective measures at reducing energy usage.

All the representatives described a similar program design. Once a client enrolls in the program, they receive a home energy assessment from a qualified auditor. The auditor then provides a list of recommendations to both the client and the CAP agency or CBO, and the CAP agency or CBO contracts the work out to contractors. All the representatives noted that although clients can reject some measure recommendations, typically, the clients want all the measures provided; additionally certain measures, like bathroom fans are legally required to be a part of the program and therefore clients cannot reject this measure.

> *"We do our utmost to provide everything possible. We have the funding to do so and as long as we have the justification, we want to be as holistic as we can on every household. We, I believe, have become very adept at braiding dollars and finding the allowances within those dollars."* –CAP Agency representative

The CAP agencies and CBOs approach to external contractors vary. While one of CBOs explained that their auditors often double as contractors, the other two CBOs indicated they have a network of contractors they call on to make the home improvements recommended by the auditors. Meanwhile, the eight CAP agency representatives explained that all the auditors are in-house employees, but that equipment installations are contracted to contractors. Contractors must participate in regular RFP bids and are then assigned work based on their prices provided; the frequency of the RFP bids range from every project to every few years.

Engaging Customers

All interviewees indicated the weatherization services are exclusive to residential customers. Although all the agencies and CBOs offer the services to multi-family apartment buildings, in general, participating customers are single-family home and/or mobile homeowners and/or tenants. Clients typically learn about the program through other social services providers, NW Natural bill inserts/communications, and community events. CAP agency representatives indicated that most of their clients are also enrolled in bill assistance programs. Interviewees explained that they do not heavily market the program because there is already substantial interest, and they want to reduce wait times as much as possible.

> "*We don't need to do marketing because we have our energy assistance list, and we don't want to keep adding people to the list. We do get some referrals from clients, housing authority, and other community orgs.*" –CAP agency Representative

Waitlists for the program vary by CAP agency and CBO. One of the CBOs explained that they avoid waitlists by making their program invite-only; the other two CBOS and all eight CAP agencies indicated they have a wait list. Wait list times range from a few months to over a year (n=6). Moreover, NW Natural and the other funding sources require substantial paperwork that can slow down the job completion timeline. These representatives understood and appreciated the need for reviews and paperwork but noted it can slow the process down.

Workforce Development

Some agency representatives explained that workforce issues are their largest barrier to increased engagement (n=3). These representatives indicated that funds are available to help more customers, but they struggle to find qualified contractors: "*the bottleneck is lack of contractors or existing contractors being busy.*" One CAP agency representative noted that "*what we are seeing is a whole trade issue. There's a shortage across the trades*." Representatives from across the CAP agencies and CBOs remarked that their existing auditors and contractors have been involved in weatherization business for many years and that they have a *"good formula nailed down*." These representatives are more concerned about the future longevity of the program due to the lack of new contractors and auditors. One CAP agency representative mentioned an internship program offered by Oregon Training Institute as a possible solution to this issue but noted the state needs more contractors.

Satisfaction

Overall, all the CAP agency and CBO representatives were pleased with their relationship with NW Natural. Everyone underscored the NW Natural team's communicativeness, commitment to serving customers, and generally helpful nature.

> "*We have the right partners and people*." –CBO representative

> "*They always try to stretch program dollars and help more clients*." –CAP agency representative

> "*I think NW Natural gas is a leader and our programs have gotten better because of their leadership*." –CAP agency representative

Moreover, multiple CAP agency representative (n=5) mentioned that NW Natural listened to their feedback and made actual programmatic changes based on that feedback, including adjusting income eligibility requirements and expanding the health and safety measure coverage. One CAP agency representative also highlighted NW Natural's allowances towards using funding for administrative costs, which greatly helps with program delivery.

"NW Natural is really great to work with; they listen to our needs and questions. They'll make changes based on our feedback – ex: they increased H&S amounts; it used to be really small and they increased; they're willing to cover more work than they had in the past." –CAP agency representative
"*They continually address things they hadn't previously addressed. Always getting better. I don't know how it will get any better*." –CAP agency representative
"Been at the table and been able to communicate with them about what's working and what's not working. It's been a great success story. NW Natural has listened to other gas programs and taken notes and made changes accordingly, they're always open to change." –CAP agency representative

Some CAP agency representatives identified challenges with the program (n=4). Challenges included the long waitlists (n=2), cost effectiveness requirements (n=3), and confusing application forms (n=2). Although these representatives acknowledged some of these challenges are out of NW Natural's control, they suggested a more streamlined application process with clear instructions on what types of measures will and will not qualify before they take the time to assess someone's home.

CBO representatives were asked to reflect on how NW Natural can better engage similar organizations in this program. Two representatives emphasized that they need to build new, and leverage existing, relationships; these representatives explained that NW Natural could strengthen their program by expanding their presence in the communities they serve through attendance at and sponsorship of community events. One of the CBO representatives noted that having a formal contract and master services agreement has also been very helpful in ensuring the program remains funded.

Contractor Interview Results

The evaluation team conducted interviews with contractors and auditors associated with the participating CAP agencies and community-based organizations that deliver residential retrofit services to customers throughout Oregon and SW Washington. In general, these interviews focused on contractors' and auditors' involvement in the NW Natural program, market conditions and customer outreach, and their satisfaction with the program.

NW Natural staff, CAP agencies, and community-based organization staff provided evaluators contact information for 33 contractors and auditors who completed projects for the NW Natural program. Evaluators reached out to each contact up to three times via phone and email and invited them to participate in a thirty-minute interview. Eight contractors and one auditor responded to interview requests. Table 5-2provides additional background information about the respondents.

Table 5-38: Interviewed CAP Agencies and CBOs

Respondent	Organization	Type	Specialty
Respondent 1	Multnomah County Community Services Division Clackamas County Weatherization Community Action Organization - Hillsboro	Contractor	Weatherization

Respondent 2	Homes for Good Housing Agency	Auditor	Audits
Respondent 3	LatinoBuilt (Portland/Salem metros)	Contractor	HVAC
Respondent 4	LatinoBuilt (Portland/Salem metros)	Contractor	Weatherization
Respondent 5	LatinoBuilt (Portland/Salem metros)	Contractor	HVAC
Respondent 6	Multnomah County Community Services Division Community Action Team – Astoria Community Action Organization – Hillsboro Yamhill Community Action Partnership Mid-Willamette Valley Community Action Agency	Contractor	Weatherization
Respondent 7	Clackamas County Weatherization	Contractor	Weatherization
Respondent 8	Clackamas County Weatherization	Contractor	Weatherization
Respondent 9	LatinoBuilt (Portland/Salem metros)	Contractor	Weatherization

Most respondents primarily focused on weatherization measures (n=6) and respondents typically completed projects in the Portland and Salem metro areas (n=9). While the one auditor interviewed was directly employed by the CAP Agency, the contractors interviewed worked on a contract basis. Seven respondents indicated they primarily work on single family homes and manufactured homes; the remaining contractor respondent indicated they primarily focus on multi-family buildings but have expanded to single family and manufactured homes when working with CAP agencies and community-based organizations for the NW Natural program.

Market Conditions & Customer Outreach

All respondents indicated the agencies they work with tend to have a steady flow of applicants and sizeable waitlists. They noted that the agencies do a good job promoting the program in their communities and providing services to community members in need. Two respondents noted that it is likely that some community members are being left behind due to language barriers and other accessibility issues, however overall, the CAP agencies and community-based organizations are going above and beyond to help their clients.

While the four respondents who work with LatinoBuilt generate their own project leads and are provided with project leads by LatinoBuilt, the CAP Agency focused respondents (n=6) noted that the agencies assign them all their NW Natural based work. One respondent went on to explain: *"we want to help expand the program, but we also don't want to flood the system. Don't want to overpromise."* Respondents indicated that each agency has an RFP process and bond limit, and that they are assigned leads based on their proposed bids and bond status. This process ensures work is both as cost effective as possible and spread out across participating contractors.

Program Participation & Process

The eight responding contractors explained that they are not involved in any of the application and rebate paperwork, but rather they are provided with a work order by the CAP Agency or community-based organization with a list of measures to install. The auditor respondent noted that these work orders are based off the recommendations provided in audits and the subsequent cost-effectiveness calculations and models.

The eight contractor respondents indicated that they are not involved in the process of determining what measures are and are not included in the work orders. However, based on the projects they have completed, they speculated that the program is comprehensive and provides the necessary assistance to improve customers' homes and reduce their utility bills.

In general, customers do not reject any of the proposed measures, as all measures are provided for free, and customers are often appreciative of the help. The measures customers are most commonly hesitant about are those that alter the general aesthetic and appearance of the home, such as door covers and vents. Customers are allowed to reject any measures – except the requisite air fan – however this rarely occurs. When customers do express concerns about certain measures or equipment the contractor explains why the measure is needed and/or refers the customer to the CAP agency for more information. Multiple respondents (n=3) indicated that customers request measures that are not part of the work order, most commonly windows; when these requests arise, contractors refer customers to CAP agencies, as they do not have the ability to add new measures without authorization.

A few respondents recalled attending training related to weatherization and HVAC upgrades and improvements, but they were not sure if these trainings were NW Natural specific (n=3). Three of the other respondents noted that they do not need any additional training opportunities as they and their staff *"have been in business for a while and know what [they're] doing."*

Program Satisfaction

Respondents were satisfied with their relationship with the CAP agencies and community-based organizations and the NW Natural program:

"The whole process is streamlined, we get detailed workorders with specific directions for abnormalities. [We are] provided the entire audit so we know what was found. We have everything we need to do the job. They're setting us up for success." –Contractor
"*NW Natural is a really great company and I think the fact that they're even willing to help us out as well as helping out their customer base. It's been great working with them."* – Contractor
"What they do is very good. Getting homes weatherized can be pretty expensive for somebody with, you know, Low-Income or fixed income or something like that, right. What they do, you know, is good. The funding that they get. I know that sometimes you know they have to get creative, sometimes on things, and they do a good job of doing that to keep the,

you know, the project going to help the homeowner, you know, get what they need." – Contractor

All the respondents ranked the process of receiving project leads, the range of qualifying measures, and the program overall as a "4" or "5" on a scale of 1-5, with "5" being "excellent." Respondents also noted they talk to their contacts at the CAP agencies and community-based organizations at least once a month and that staff are very responsive and communicated. One respondent suggested the CAP agencies and community-based organizations digitize as much of the process as possible rather than relying on paperwork orders and notes; none of the other respondents had ideas or suggestions for improvement. This lack of negative feedback and suggestions for improvement underscore the success and appreciation of the program amongst participating contractors and the customers they serve.

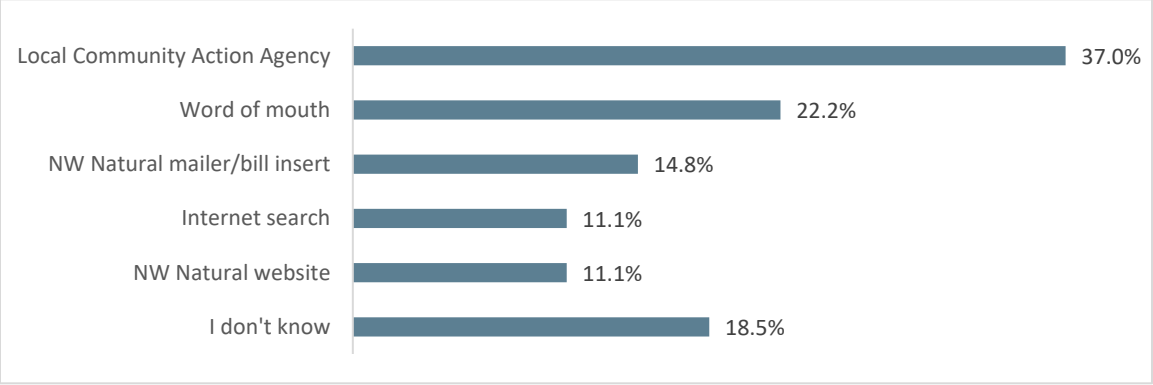
Participant Survey Results

The Evaluators conducted a survey of Northwest Natural's Low-Income Program participants in program year 2023 to gather feedback about customers' engagement with and experience of the program. The most recent program year was utilized for participant surveys to ensure participants would be able to recall their experiences with the program. Participants were contacted via phone and/or email three times and asked to complete a survey. In total, evaluators had contact information for 168 unique program participants and 35 responded to survey efforts. Three respondents did not remember receiving weatherization nor heating related measures from NW and five respondents stopped responding to questions mid survey and were excluded from analysis. Twenty-seven respondents were included in the analysis.

Program Awareness & Motivation to Participate

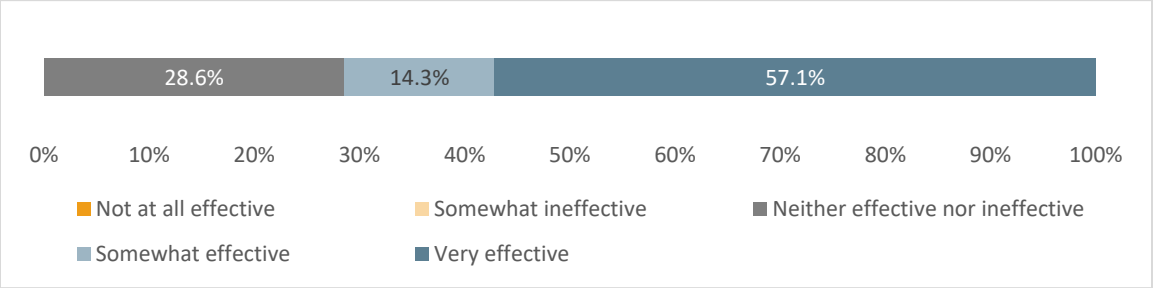
Respondents learned about the program through a variety of avenues, most commonly through their local Community Action Agency (37.0%, n=10) or word of mouth (22.0%, n=6) (Figure 5-1).

Figure 5-1: Program Awareness (n=498)



Just over half of the respondents remember receiving informational brochures or materials about the energy-efficiency program when they met with CAP Agency and/or local non-profit organization representatives (53.9%, n=14). Respondents who remembered receiving brochures noted the materials highlighted weatherization measures (n=8), furnaces (n=6), and water heaters (n=5) and most respondents found the materials effective in communicating the benefits of the program (Figure 5-2). Additionally, respondents noted that the CAP agency representatives highlighted the cost saving potential of receiving the upgrades (n=8), the free nature of the program (n=3), and the potential to improve the comfort of their home (n=3). Respondents did not provide any feedback on how to improve the information provided. Only one respondent had concerns about the program before enrolling; they were skeptical of the offerings because they were free.

Figure 5-2: Informational Material's Effectiveness (n=14)



Respondents were motivated to participate to get their old equipment upgraded (n=12), save energy and money (n=4), and improve the comfort of their home (n=2). Respondents ranked increasing their home's energy efficiency as the most important factor they consider when considering home improvements, followed by improving health and safety, improving home comfort, and increasing home value (Table 5-3).

Table 5-39: Factors to Consider in Making Home Improvements (n=21)

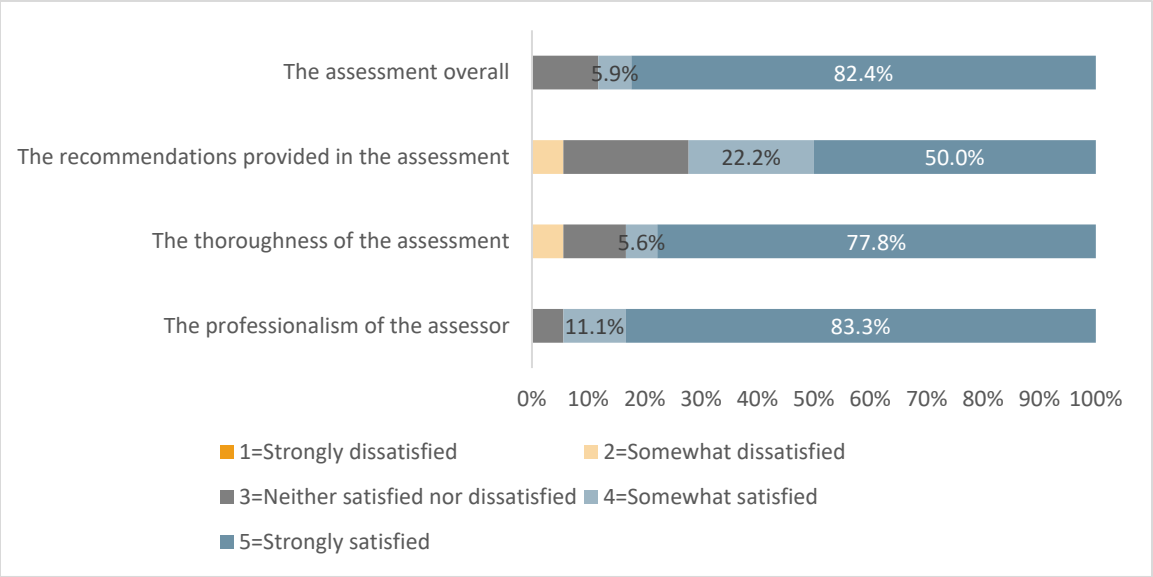
	1st	2nd	3rd	4th
Increasing home's energy efficiency	42.9%	42.9%	9.5%	4.8%
Improve your health and safety in your home	38.1%	19.1%	33.3%	9.5%
Improve your comfort in your home	14.3%	38.1%	47.6%	0.0%
Increase home value	4.8%	0.0%	9.5%	85.7%

Assessment and Contractor Experience

Two-thirds of respondents remember receiving an energy assessment of their home (66.7%, n=18); of these respondents, two-thirds remember receiving recommendations from their energy auditor (66.7%, n=12). Two respondents noted they did not act on some of the recommendations provided, including installing vents on the base of each door (n=1), as well as replacing attic, floor, and wall insulation (n=1), and windows (n=1). These respondents explained they did not like the aesthetics of the door vents (n=1) and that their roof needed to be repaired before they could install the new insulation and windows (n=1).

Respondents who remember receiving an assessment (n=18) indicated they were satisfied with the assessment overall, the recommendation provided, the thoroughness of the assessment, and the professionalism of the assessor (Figure 5-3).

Figure 5-3: Assessment Satisfaction (n=18)



Respondents found their contractor through a variety of sources including the internet, a personal contact, and referral from community agency (Figure 5-4). In general, respondents agreed that the work was scheduled and completed in a reasonable amount of time and the contractor was professional and courteous (Figure 5-5).

Figure 5-4: Contractor Source (n=27)

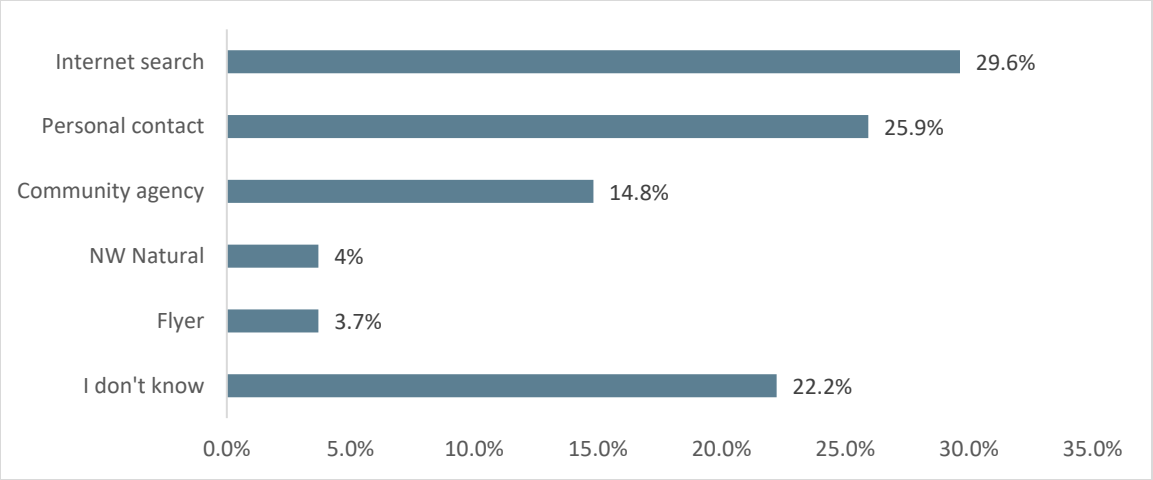
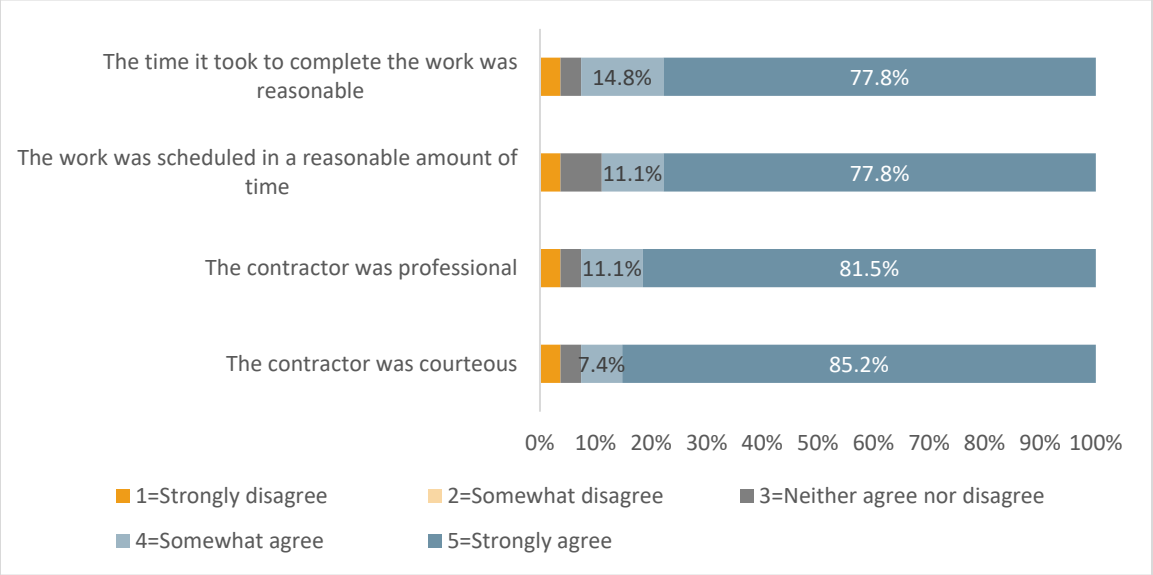


Figure 5-5: Contractor Satisfaction (n=27)

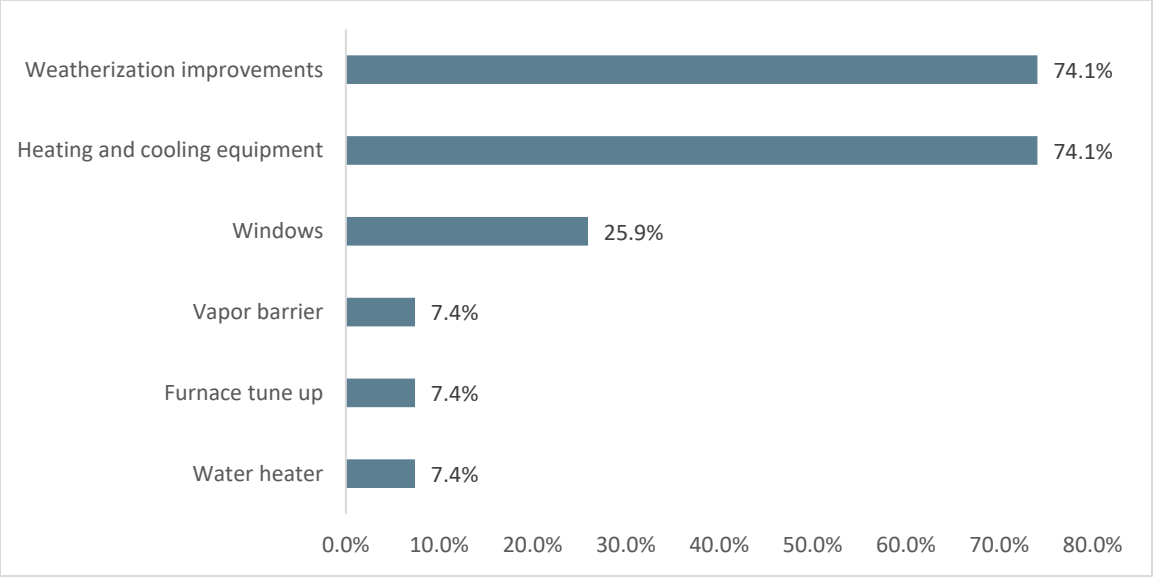


Three respondents noted their contractor suggested additional upgrades, including new windows (n=2) and a new refrigerator and water heater (n=1).

Equipment Received

Respondents received a variety of different equipment upgrades from the program, most commonly weatherization improvements and heating and cooling equipment upgrades (Figure 5-6). All the respondents reported that the equipment they received from the program was still installed and working.

Figure 5-6: Measures Received (n=27)



More than half of the respondents explained that there were additional measures they wanted, but did not receive (59.3%, n=16); the most common desired but not provided measures were windows and air conditioners (Table 5-4).

Table 5-40: Desired Measures (n=16)

Measure	n
Windows	6
Air conditioner	4
Additional insulation	3
Roof	2
Front door	1
Solar panels	1
Kitchen and bathroom vents	1
Electrical panel	1

Program Satisfaction

Respondents were generally satisfied with NW Natural as their natural gas service provider and their experience with the program overall (Figure 5-7). About half of respondents did not have strong opinions regarding the application process, which may indicate they were not involved in this process and the CAP Agency completed the application on their behalf. About two-thirds of respondents indicated that participation in the program increased their satisfaction with NW Natural (63.0%, n=27); the remaining respondents noted that participation in the program did not increase nor decrease their

satisfaction with the utility (Figure 5-8). Moreover, almost all respondents indicated they would recommend the program to others (88.9%, n=25) (Figure 5-9). More than three-quarters of respondents believe NW Natural is a very or extremely trustworthy source of information regarding energy savings in the home (77.8%, n=21).

Only two respondents provided negative reports about their experience with the program, indicating that they wished their fireplace could have been replaced (n=1) and that the contractor did not seal their windows and door properly (n=1).

Figure 5-7: Program Satisfaction (n=26)

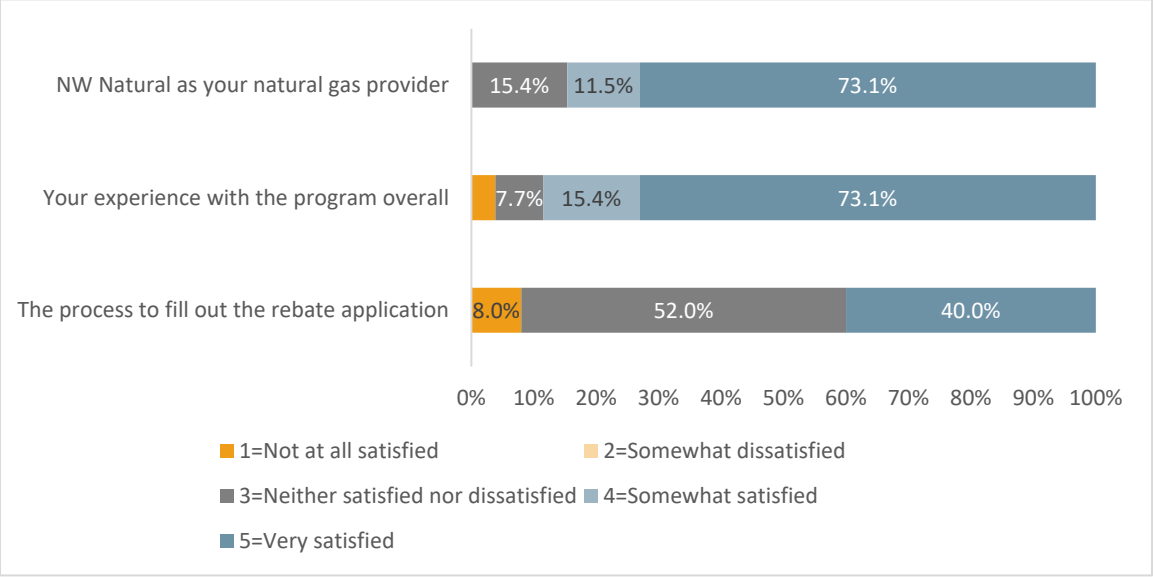


Figure 5-8: Impact of Program on Satisfaction with NW Natural (n=27)

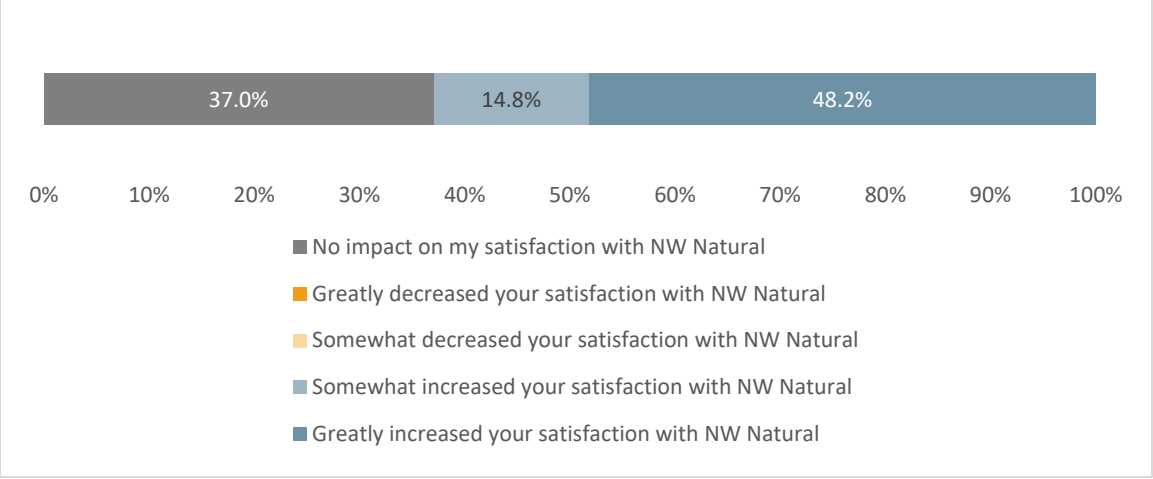
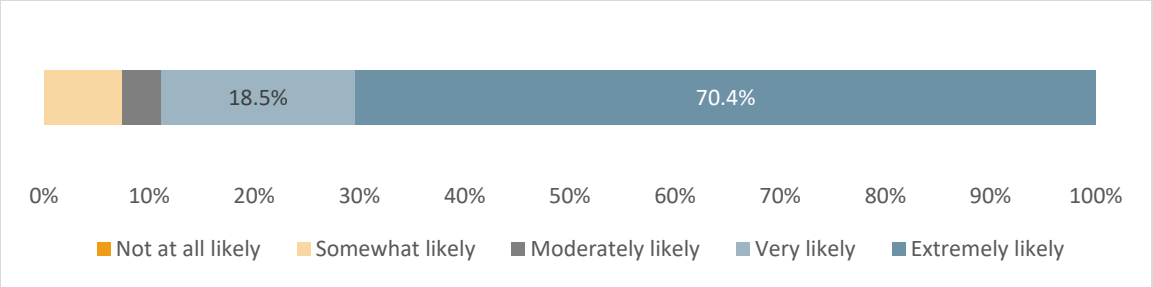


Figure 5-9: Likelihood to Recommend Program (n=27)



Demographics

Table 5-5 describes the demographics of survey respondents. All respondents confirmed their annual income was at or below 80% the area median income of their county.

Table 5-41: Demographics (n=27)

Answer	%	Count
Homeownership		
Own	81.5%	22
Rent	11.1%	3
Own and rent to someone else	0.0%	0
Prefer not to answer	7.4%	2
Home Type		
Single-family house detached	85.2%	23
Mobile or manufactured home	11.1%	3
Apartment with 2 to 4 units	0.0%	0
Apartment with 5 or more units	0.0%	0
Prefer not to answer	3.7%	1
Building Age		
Before 1950	31.8%	7
1950 to 1959	9.1%	2
1960 to 1969	9.1%	2
1970 to 1979	22.7%	5
1980 to 1989	9.1%	2

1990 to 1999	18.2%	4
2000 to 2009	0.0%	0
2010 or later	0.0%	0
Don't know	0.0%	0
Prefer not to answer	0.0%	0
Household Size		
1 person	40.7%	11
2 people	22.2%	6
3 people	7.4%	2
4 people	11.1%	3
5 people	3.7%	1
6 people	3.7%	1
7 people	0.0%	0
8 or more people	3.7%	1
Prefer not to answer	7.4%	2
Education		
Did not graduate high school	0.0%	0
High school graduate	22.2%	6
Associates degree, vocation/ technical school, or some college	18.5%	5
Four-year college degree	25.9%	7
Graduate or professional degree	22.2%	6
Prefer not to answer	11.1%	3
Race/Ethnicity		
American Indian or Alaska Native	7.4%	2
East Asian	3.7%	1
South Asian	0.0%	0
Black or African American	0.0%	0
Hispanic, Latino, or Spanish origin	3.7%	1

Native Hawaiian or Pacific Islander	0.0%	0
Middle Eastern or North African	0.0%	0
White or Caucasian	74.1%	20
Another race, ethnicity, or origin not listed	0.0%	0
Prefer not to answer	11.1%	3

Non-Participant Survey Results

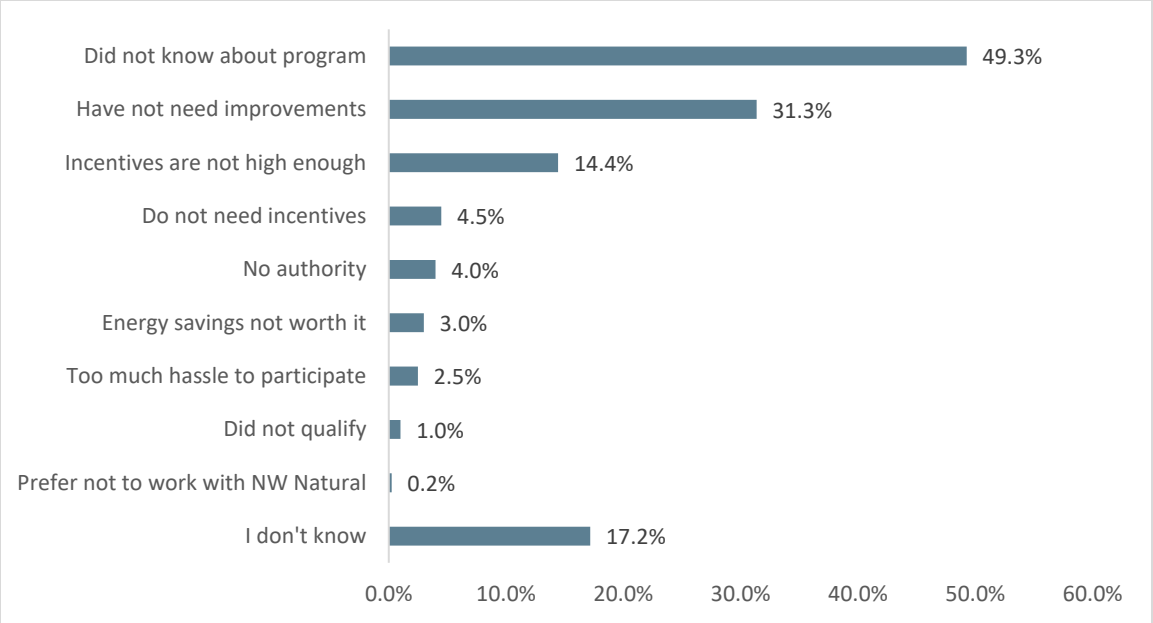
The Evaluators conducted a survey of Northwest Natural customers who qualified for the Low-Income Program but did not participate, to gather feedback about customers' awareness of NW Natural's offerings, opinions towards energy efficiency, and energy use behaviors. Participants were contacted via email two times and asked to complete a survey. In total, the Evaluators had valid emails for 5,495 unique customers; 520 responded to survey efforts. 118 respondents were excluded from analyses because they reported having no authority over the improvements made to their home (n=106) or they had received assistance from NW Natural to make improvements to their home (n=12). In total, 402 responses were included in the analyses.

Engagement with NW Natural

Most respondents were homeowners and therefore had full authority to make changes and improvements to their home (81.1%, n=326); the remaining respondents were renters with some-to-full authority to make and/or request improvements (18.9%, n=76). Almost three-quarters of respondents indicated they had not replaced or upgraded any gas equipment in the past three years (70.4%, n=283). Among the 119 respondents who had replaced equipment, heating equipment, water heaters, and thermostats were the most popular equipment purchased. More than half of the respondents participated in NW Natural's bill assistance program (62.6%, n=251).

Respondents explained that they have not engaged in NW Natural's weatherization and furnace replacement program for a variety of reasons, including not knowing about the program (49.3%, n=198) and not needing improvements (31.3%, n=126) (Figure 5-1). Moreover, when asked directly, 80.4% (n=323) reported not knowing NW Natural offers weatherization and furnace replacement in partnership with local community agencies.

Figure 5-10: Reasons for Not Participating (n=402)



Among respondents who were previously aware of NW Natural's weatherization and furnace replacement assistance (n=79), most respondents had learned about the offerings through NW Natural mailers, website, or email (Figure 5-11). Respondents were most familiar with NW Natural's bill assistance and heating and cooling equipment incentive programs (Figure 5-12).

Figure 5-11: Program Awareness Source (n=79)

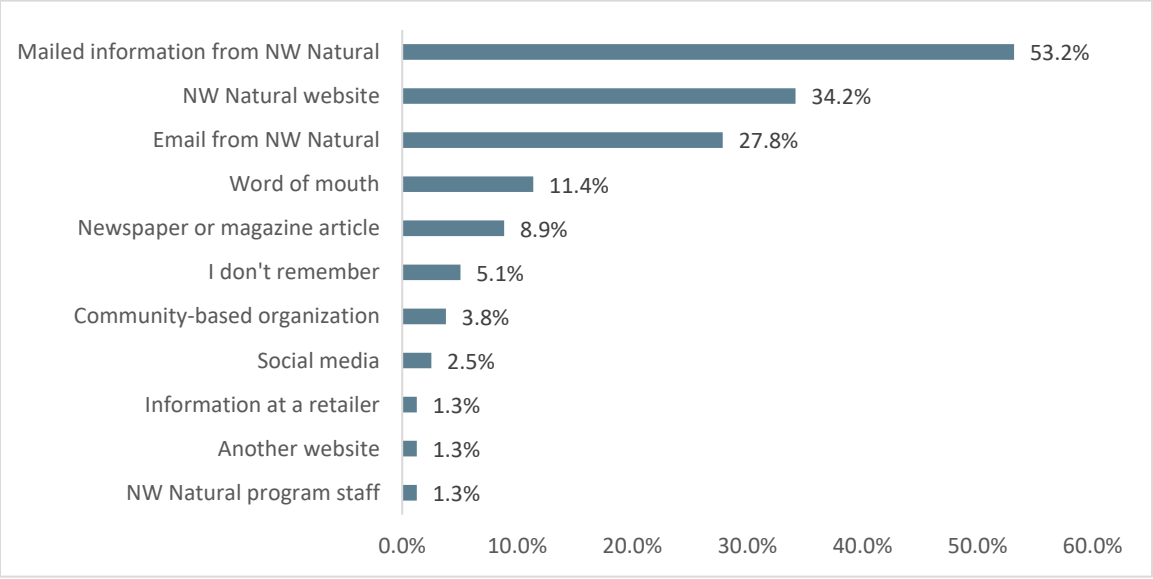
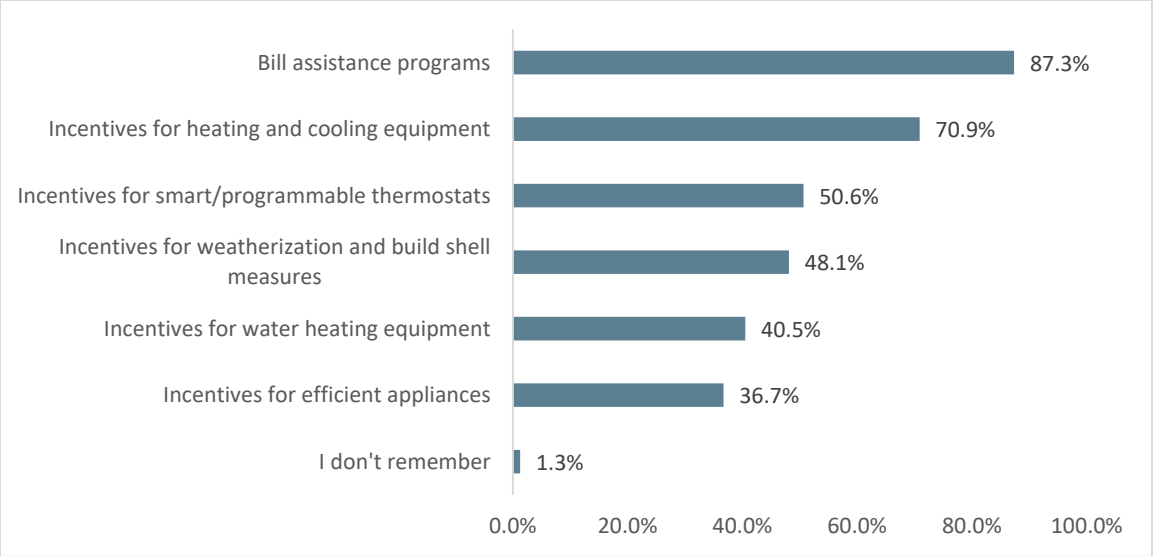


Figure 5-12: Program Awareness Levels (n=79)



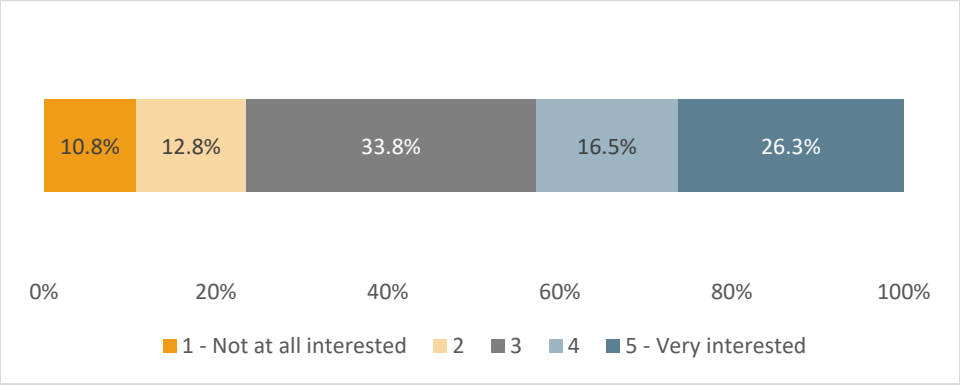
More than half of all non-participant respondents expressed interest in making energy efficient improvements to their home (61.7%, n=246). These respondents were most interested in weatherization and heating and cooling equipment updates (Table 5-6). Overall, 42.8% (n=171) indicated they were somewhat or very interested in participating in NW Natural's energy efficiency programs. ^

Respondents explained that the cost of equipment upgrades were the main factor preventing them from engaging in this type of program (51.0%, n=204); other reasons for not engaging included not needing new equipment, not having authority to make decisions, and needing more information about the program.

Table 5-42: Services Respondents are Interested In (n=246)

	%	n
Home weatherization	74.0%	182
Heating/cooling equipment	63.4%	156
Water heating equipment	44.3%	109
Smart/programmable thermostats	38.6%	95
Efficient appliances	36.6%	90
Windows	2.0%	5
Not sure	1.6%	4

Figure 5-13: Interest in NW Natural's Programs (n=400)



Respondents suggested NW Natural increases awareness of the programs through enhanced marketing, increased attendance at community events, and easier to understand application materials (n=55). Additionally, 50 respondents suggested NW Natural offer higher incentives and rebates. Together, these sets of comments suggest awareness of NW Natural's assistance for Low-Income is limited and many eligible customers do not realize they may qualify for free weatherization and heating equipment updates.

Current Energy Usage

About two-thirds of respondents believed their heating and/or cooling equipment are the largest energy consumer in their home (Figure 5-14). Most respondents fueled their homes with natural gas (82.0%, n=327). The age of respondents' heating system varied; one-third of respondents reported their heating system was less than 10 years old (32.6%, n=124), while half of respondents indicated their heating system was 10-20 years old or more than 20 years old (Figure 5-15). More than half of respondents had serviced their heating system in the last three years (59.3%, n=226) (Figure 5-16). Just over half of respondents have a programmable thermostat (53.9%, n=215); the remaining respondents either have a manual thermostat (17.7%, n=71), smart thermostat (21.8%, n=87), or are not sure (6.5%, n=26).

Figure 5-14: Largest Energy Consumers (n=399)

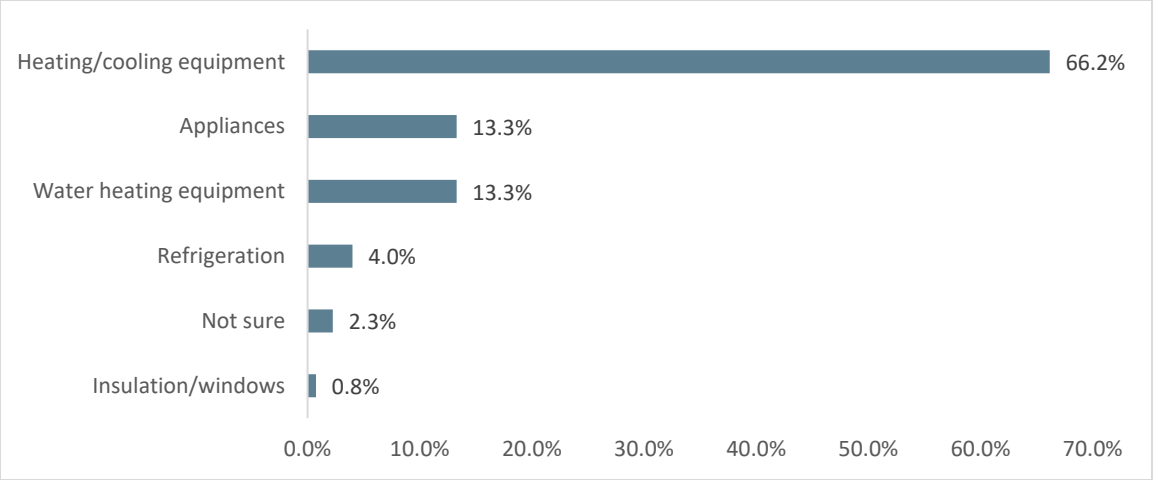


Figure 5-15: Age of Heating System (n=381)

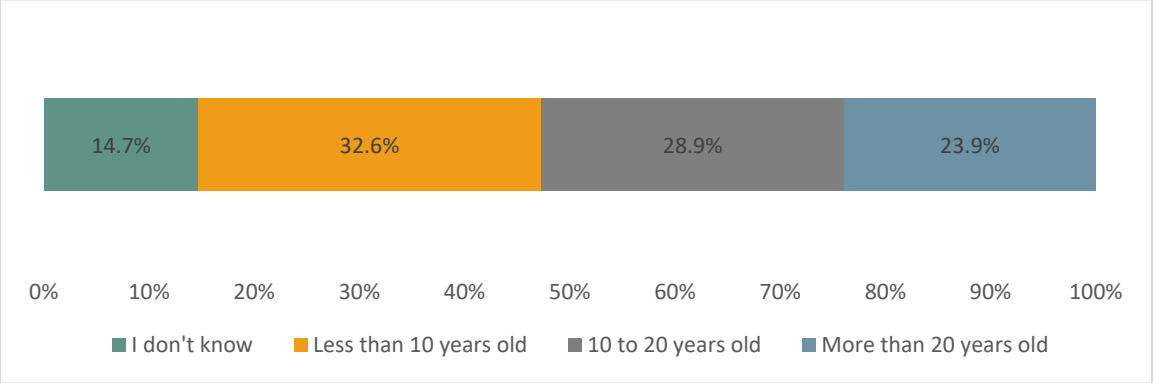
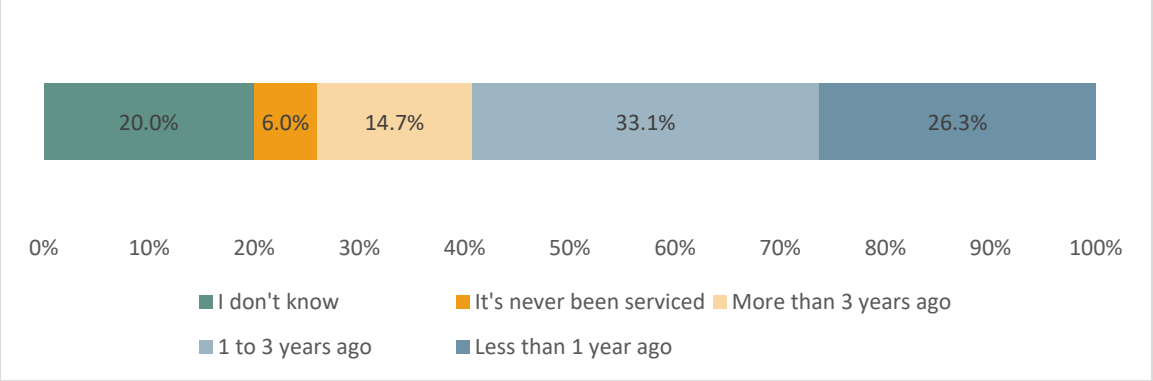


Figure 5-16: Time of Most Recent Heating System Service (n=381)



Demographics

Table 5-5 describes the demographics of survey respondents. 285 respondents provided the data necessary to verify their eligibility for the NW Natural Low-Income program (annual household income is at or below 80% the area median income of their county); among these respondents 94.0% (n=268) qualified for the programs.

Table 5-43: Demographics (n varies)

Answer	%	Count
Homeownership (n=400)		
Own	79.8%	319
Rent	16.5%	66
Own and rent to someone else	0.3%	1
Prefer not to answer	3.5%	14
Home Type (n=397)		
Single-family house detached	83.4%	331
Single-family house attached to one or more other houses	11.8%	47
Mobile or manufactured home	2.3%	9
Apartment with 2 to 4 units	0.5%	2
Apartment with 5 or more units	0.8%	3
Prefer not to answer	1.3%	5
Building Age (n=317)		
Before 1950	16.4%	52
1950 to 1959	9.2%	29
1960 to 1969	7.3%	23
1970 to 1979	9.2%	29
1980 to 1989	5.7%	18
1990 to 1999	17.0%	54
2000 to 2009	19.6%	62
2010 to 2019	7.6%	24
2020 to Present	3.2%	10
I don't know	4.1%	13
Prefer not to answer	1.0%	3
Household Size (n=392)		
1 person	25.1%	99

2 people	31.7%	125
3 people	16.0%	63
4 people	7.3%	29
5 people	8.6%	34
6 people	5.1%	20
7 people	0.5%	2
8 or more people	0.5%	2
Prefer not to answer	5.3%	21
Education (n=387)		
Did not graduate high school	2.3%	9
High school graduate	18.4%	71
Associates degree, vocation/ technical school, or some college	32.0%	124
Four-year college degree	26.9%	104
Graduate or professional degree	13.7%	53
Prefer not to answer	6.7%	26
Race/Ethnicity (n=400)		
White or Caucasian	73.3%	293
Prefer not to answer	11.3%	45
Hispanic, Latino, or Spanish origin	8.0%	32
Black or African American	5.5%	22
East Asian (e.g. Chinese, Filipino, Asian Indian, Vietnamese, Korean, Japanese)	5.0%	20
American Indian or Alaska Native	2.8%	11
Native Hawaiian or Pacific Islander	0.5%	2
South Asian (e.g. Asian Indian, Pakistani, Bangladeshi)	0.3%	1
Middle Eastern or North African	0.3%	1
Jewish	0.3%	1
Mixed American	0.3%	1
Syrian	0.3%	1

Polish	0.3%	1

Process Conclusions and Recommendations

The following section details the Evaluators' conclusions and recommendations for the Low-Income programs.

Conclusion 1: NW Natural's Low-Income program utilizes lenient qualification criteria and provides comprehensive measure coverage. Stakeholders from across the interview groups – program staff, CAP Agency and CBO staff, and trade allies – remarked on NW Natural's comprehensive measure coverage and willingness to stretch the boundaries of the services they can provide. Not only did NW Natural modify the qualification criteria from 200% FPL to 80% AMI in response to requests by the CAP Agency, but they also expanded health and safety qualifying measures, allowing for more holistic coverage and home updates for customers. CAP agency and CBO staff noted that NW Natural's program has some of the most lenient and flexible qualification criteria – as compared to other similar programs – and participating trade allies indicated that the measures covered are thorough.

Conclusion 2: Most participants and eligible non-participants participate in the CAP Agencies and CBO energy related bill assistance programs. Waitlist times for the program vary across agencies. One CBO representative explained that they avoid waitlists by making their program invite-only, while other CBO representatives and CAP agency staff indicated their wait list times range from a few months to over a year.

Conclusion 3: Non-participants respondents explained that the cost of equipment upgrades was the main factor preventing them from engaging in this type of program, suggesting awareness of NW Natural's assistance for Low-Income is limited and many eligible customers do not realize they may qualify for free weatherization and heating equipment updates.

Recommendation 1: Although wait lists for some of the weatherization and HVAC programs can be lengthy, CAP agency and CBO staff should continue to enroll existing clients into this program to ensure comprehensive energy assistance, as more than half of all non-participant respondents expressed interest in making energy efficient improvements to their home.

Conclusion 4: Workforce development issues limit program expansion. Some CAP Agency representatives explained that workforce issues are their largest barrier to increased engagement. These representatives indicated that funds are available to help more customers, but they struggle to find qualified contractors. Representatives from across the CAP agencies and CBOs remarked that their existing auditors and contractors have been involved in the weatherization business for many years, but that they are concerned about the future longevity of the program due to the lack of new contractors and auditors. One CAP agency representative mentioned an internship program offered by Oregon Training Institute as a possible solution to this issue but noted the state needs more contractors.

Recommendation 2: NW Natural should consider partnering with the Oregon Training Institute and other similar organizations to help offer more workforce development and training opportunities for future contractors and trade allies.

Conclusion 5: CBO representatives underscored the importance of leveraging existing relationships in communities when promoting the program.

Recommendation 3: NW Natural can continue to strengthen their program by expanding their presence in the communities they serve through attendance at and sponsorship of community events. One of the CBO representatives also noted that having a formal contract and master services agreement has also been very helpful in ensuring the program remains funded.

Conclusion 6: Satisfaction across stakeholder groups – CAP agency and CBO staff, contractors, and participants – was high. Interview respondents highlighted NW Natural's communicativeness and willingness to answer questions, while most survey respondents indicated they would recommend the program to others and that they believe NW Natural is a very or extremely trustworthy source of information regarding energy savings in the home.

Appendix A: Cost-Effectiveness Testing

Summary

The Evaluators estimated the cost-effectiveness for the overall energy efficiency of programs, based on costs and savings estimates provided by NW Natural and their third-party implementers. This appendix provides the cost-effectiveness results, as well as a brief overview of the approach taken by the Evaluators. The tables below presents the cost-effectiveness results for the most recent evaluation periods (Py2014-PY2017 and PY2018-PY2022).

Table 6-44: Cost-Effectiveness Results, PY2014-PY2017

Program	TRC	UCT	RIM	PCT	SCT
OLIEE	2.08	0.25	0.20	N/A	2.34
WALIEE	1.37	0.23	0.19	N/A	1.57
Total	**1.99**	**0.25**	**0.20**	**N/A**	**2.25**

Table 6-45: Cost-Effectiveness Results, PY2018-PY2022

Program	TRC	UCT	RIM	PCT	SCT
OLIEE	2.31	0.23	0.19	N/A	2.60
WALIEE	2.08	0.33	0.25	N/A	2.38
Total	**2.29**	**0.24**	**0.19**	**N/A**	**2.58**

Methods

The California Standard Practice Model was used as a guideline for the calculations, along with guidance from the 2020-2022 and 2023 Natural Gas Demand-Side Management (DSM) plans and the AR TRM V9.2. The cost-effectiveness analysis methods that were used in this analysis are among the set of standard methods used in this industry and include the Total Resource Cost Test (TRC), Utility Cost Test (UCT)[7], Ratepayer Impact Measure Test (RIM), Participant Cost Test (PCT) and Societal Cost Test (SCT). All tests weigh monetized benefits against costs. These monetized amounts are presented as Net Present Value (NPV) evaluated over the lifespan of the measure. The benefits and costs differ for each test based on the perspective of the test. The definitions below are taken from the California Standard Practice Manual.

The TRC measures the net costs of a demand-side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs.

[7] The UCT is also referred to as the Program Administrator Cost Test (PACT).

The UCT measures the net costs of a demand-side management program as a resource option based on the costs incurred by the program administrator (including incentive costs) and excluding any net costs incurred by the participant. The benefits are similar to the TRC benefits. Costs are defined more narrowly.

The PCT is the measure of the quantifiable benefits and costs to the customer due to participation in a program. Since many customers do not base their decision to participate in a program entirely on quantifiable variables, this test cannot be a complete measure of the benefits and costs of a program to a customer.

The RIM test measures what happens to customer bills or rates due to changes in utility revenues and operating costs caused by the program. Rates will go down if the change in revenues from the program is greater than the change in utility costs. Conversely, rates or bills would go up if revenues collected after program implementation is less than the total costs incurred by the utility in implementing the program. This test indicates the direction and magnitude of the expected change in customer bills or rate levels.

The SCT test measures the net costs of a demand-side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs in the same way that the TRC measures these, but utilizes a societal discount rate, which is lower than the discount rate used for the TRC. The lower discount rate effectively assigns a higher net present value to program benefits that occur in the future.

A common misperception is that there is a single best perspective for evaluation of cost-effectiveness. Each test is useful and accurate, but the results of each test are intended to answer a different set of questions. The questions to be addressed by each cost test are shown in the table below.[8]

Table 6-46: Questions Addressed by the Various Cost Tests

Cost Test	Questions Addressed
Participant Cost Test (PCT)	Is it worth it to the customer to install energy efficiency?
	Is it likely that the customer wants to participate in a utility program that promotes energy efficiency?
Ratepayer Impact Measure (RIM)	What is the impact of the energy efficiency project on the utility's operating margin?
	Would the project require an increase in rates to reach the same operating margin?
Utility Cost Test (UCT)	Do total utility costs increase or decrease?
	What is the change in total customer bills required to keep the utility whole?
Total Resource Cost Test (TRC)	What is the regional benefit of the energy efficiency project (including the net costs and benefits to the utility and its customers)?
	Are all of the benefits greater than all of the costs (regardless of who pays the costs and who receives the benefits)?

[8] https://www.epa.gov/energy/understanding-cost-effectiveness-energy-efficiency-programs

	Is more or less money required by the region to pay for energy needs?

Overall, the results of all five cost-effectiveness tests provide a more comprehensive picture than the use of any one test alone. The TRC and SCT cost tests address whether energy efficiency is cost-effective overall. The PCT, UCT, and RIM address whether the selection of measures and design of the program are balanced from the perspective of the participants, utilities, and non-participants. The scope of the benefit and cost components included in each test are summarized in the table below.[9]

Table 6-47: Benefits and Costs Included in each Cost-Effectiveness Test

Test	Benefits	Costs
PCT (Benefits and costs from the perspective of the customer installing the measure)	Incentive payments	Incremental equipment costs
	Bill Savings	Incremental installation costs
	Applicable tax credits or incentives	
UCT (Perspective of utility, government agency, or third party implementing the program	Energy-related costs avoided by the utility	Program overhead costs
	Capacity-related costs avoided by the utility, including supply and distribution	Utility/program administrator incentive costs
TRC (Benefits and costs from the perspective of all utility customers in the utility service territory)	Energy-related costs avoided by the utility	Program overhead costs
	Capacity-related costs avoided by the utility, including supply and distribution	Program installation costs
	Additional resource savings	Incremental measure costs
	Monetized non-energy benefits as outlined by the TRM.	
RIM (Impact of efficiency measure on non-participating ratepayers overall)	Energy-related costs avoided by the utility	Program overhead costs
	Capacity-related costs avoided by the utility, including supply and distribution	Lost revenue due to reduced energy bills
		Utility/program administrator installation costs

Economic Inputs

[9] *Ibid*.

The Evaluators used the avoided costs, discount rates, and other economic inputs provided by NW Natural for the cost benefit analysis.

Additionally, the table below outlines the discount rates, escalation rate and avoided costs used in the cost-effectiveness analysis.

Table 6-48: Economic Inputs for Cost-Effectiveness Analysis

Discount Rates	
Utility (TRC)	3.87%
Utility (UCT)	3.87%
Utility (RIM)	3.87%
Societal (SCT)	3.00%
Participant (PCT)	10.00%
Line Losses	
Line Losses	0.00%
Escalation rate	2.45%
Avoided Costs	
Avoided Energy ($/Therm)	$0.961

Arrearage and Disconnections Results

The table below displays the observed average differences in arrearages, disconnects, and disconnection notices between the matched treatment and control groups of each cohort. Data on arrearages is complete only for the latest evaluation period of customers in Oregon. On average, control customers accrued $97.98 more in annualized arrearages during 2023 than during 2017, while treatment customers on average accrued $115.00 less, resulting in a difference-in-difference savings of $212.97[10]. Assuming a participant discount rate of 10%, the NEB adder per participant is $21.30 for the arrearage reduction.

Additionally, the average number of disconnects and disconnection notices per customer decreased more in the treatment group than in the control group in the post-period year for every cohort with complete data except for Oregon customers during the PY2014-PY2017 evaluation period, where disconnects decreased more for control customers than treatment customers. However, the results for disconnects and disconnection notices were not statistically significant for any cohort.

Table 6-49: Arrearage and Disconnections Results

[10] Annualized arrearage estimates were based on 90-day arrearage totals expected to increase at the same rate over the course of one year.

Statistic	Cohort	Difference in Annual Averages (Post - Pre)		Savings	Statistical Significance (alpha < .05)
		Control	Treatment		
Arrearages	EP3 (OR)	$97.98	$(115.00)	$ 212.97	Yes
Disconnects	EP2 (OR)	-0.026	-0.010	-0.016	No
Disconnects	EP3 (OR)	0.006	-0.015	0.021	No
Disconnection Notices	EP1 (OR)	0.268	-0.773	1.041	No
Disconnection Notices	EP2 (OR)	-0.429	-0.670	0.241	No
Disconnection Notices	EP3 (OR)	1.012	-0.693	1.705	No
Disconnection Notices	WA	0.468	0.143	0.325	No

Program-Level Results

Sections below show results, benefits, costs and net benefits for the most recent evaluation periods (PY2014-PY2017and PY2018-PY2022).

Cost-Effectiveness Results for Evaluated Program Years

The tables below outline the results for each test for both Low-Income programs.

Table 6-50: Cost-Effectiveness Results by Program, PY2014-PY2017

Program	TRC	UCT	RIM	PCT	SCT
OLIEE	2.08	0.25	0.20	N/A	2.34
WALIEE	1.37	0.23	0.19	N/A	1.57
Total*	**1.99**	**0.25**	**0.20**	**N/A**	**2.25**

*Sums may differ due to rounding.

Table 6-51: Cost-Effectiveness Benefits by Program, PY2014-PY2017

Program	TRC Benefits	UCT Benefits	RIM Benefits	PCT Benefits	SCT Benefits
OLIEE	$2,165,512	$2,146,214	$2,146,214	$9,123,859	$2,436,282
WALIEE	$187,075	$186,031	$186,031	$803,001	$214,087
Total*	**$2,352,587**	**$2,332,245**	**$2,332,245**	**$9,926,860**	**$2,650,370**

*Sums may differ due to rounding.

Table 6-52: Cost-Effectiveness Costs by Program, PY2014-PY2017

Program	TRC Costs	UCT Costs	RIM Costs	PCT Costs	SCT Costs
OLIEE	$1,043,227	$8,582,884	$10,729,099	$0	$1,043,227
WALIEE	$136,537	$809,253	$995,284	$0	$136,537
Total*	**$1,179,764**	**$9,392,137**	**$11,724,382**	**$0**	**$1,179,764**

*Sums may differ due to rounding.

Table 6-53: Cost-Effectiveness Net Benefits by Program, PY2014-PY2017

Program	TRC Net Benefits	UCT Net Benefits	RIM Net Benefits	PCT Net Benefits	SCT Net Benefits
OLIEE	$1,122,285	-$6,436,670	-$8,582,884	$9,123,859	$2,436,282
WALIEE	$50,538	-$623,222	-$809,253	$803,001	$214,087
Total*	**$1,172,823**	**-$7,059,892**	**-$9,392,137**	**$9,926,860**	**$2,650,370**

*Sums may differ due to rounding.

Table 6-54: Cost-Effectiveness Results by Program, PY2018-PY2022

Program	TRC	UCT	RIM	PCT	SCT
OLIEE	2.31	0.23	0.19	N/A	2.60
WALIEE	2.08	0.33	0.25	N/A	2.38
Total*	**2.29**	**0.24**	**0.19**	**N/A**	**2.58**

*Sums may differ due to rounding.

Table 6-55: Cost-Effectiveness Benefits by Program, PY2018-PY2022

Program	TRC Benefits	UCT Benefits	RIM Benefits	PCT Benefits	SCT Benefits
OLIEE	$3,360,868	$3,335,947	$3,335,947	$15,562,557	$3,781,270
WALIEE	$300,636	$299,123	$299,123	$961,630	$343,856
Total*	**$3,661,504**	**$3,635,070**	**$3,635,070**	**$16,524,188**	**$4,125,126**

*Sums may differ due to rounding.

Table 6-56: Cost-Effectiveness Costs by Program, PY2018-PY2022

Program	TRC Costs	UCT Costs	RIM Costs	PCT Costs	SCT Costs
OLIEE	$1,455,276	$14,509,972	$17,845,919	$0	$1,455,276
WALIEE	$144,593	$893,157	$1,192,280	$0	$144,593

Total*	**$1,599,869**	**$15,403,128**	**$19,038,199**	**$0**	**$1,599,869**

*Sums may differ due to rounding.

Table 6-57: Cost-Effectiveness Net Benefits by Program, PY2018-PY2022

Program	TRC Net Benefits	UCT Net Benefits	RIM Net Benefits	PCT Net Benefits	SCT Net Benefits
OLIEE	$1,905,592	-$11,174,024	-$14,509,972	$15,562,557	$3,781,270
WALIEE	$156,042	-$594,033	-$893,157	$961,630	$343,856
Total*	**$2,061,634**	**-$11,768,058**	**-$15,403,128**	**$16,524,188**	**$4,125,126**

*Sums may differ due to rounding.

Appendix B: Unit Energy Savings

Table 7-1 provides UES (or deemed) Therms savings for measures found in project documentation or program tracking data.

The Evaluators provide deemed measure savings to assist NW Natural with savings estimates, which may be useful in future program years. If the program measures change substantially, the whole-home billing analysis results from the evaluated periods in this report may not provide accurate estimates of whole-home savings in future program years.

The Evaluators used various sources to calculate deemed savings estimates such as the RTF, TRMs, and previous studies. The Evaluators identified separate efficiency levels for each measure where applicable and assigned savings using the sources mentioned in Table 7-1. The Evaluators then took an average of the Unit Energy Savings across different measure efficiency levels for the projects that had complete data. This resulted in average household level savings per measure which the Evaluators then used to assign to the sample based on document verification findings. The average savings per household using the deemed savings method resulted in 79.42 Therms. However, the Evaluators found 96 projects that did not provide enough specification information to calculate savings. Excluding these projects causes the average savings per household to increase to 119.34 Therms.

Table 7-58: Deemed Measure Savings, TRM-based

Measure	Efficiency	Savings % of Sampled Projects	Measure Unit	Measure Unit Average	Unit Energy Savings (Therms)	TRM Source
Attic/Ceiling Insulation	R0 to R38	12.45%	SQFT	799	164.1	RTF: ResSFWx_v6_2
	R0 to R49	5.24%	SQFT	843	176.0	RTF: ResSFWx_v6_2
	R11 to R38	2.62%	SQFT	943	65.2	RTF: ResSFWx_v6_2
	R11 to R49	3.28%	SQFT	800	58.0	RTF: ResSFWx_v6_2
	R19 to R38	1.31%	SQFT	825	24.3	RTF: ResSFWx_v6_2
	R19 to R49	0.66%	SQFT	676	22.6	RTF: ResSFWx_v6_2
	R30 to R49	0.98%	SQFT	775	12.6	RTF: ResSFWx_v6_2
Direct Vent Space	Unknown	Unknown	Unknown	Unknown	81.7	Avisa TRM

Duct	R0 to R11	9.44%	SQFT	206	35.8	RTF: ResSFWx_v6_2
Duct Sealing	Unknown	13.94%	CFM50 reduction	67	44.1	Illinois TRM Algorithm 5.3.4
Faucet Aerators	1.5 GPM	0.00%	Efficiency Value	Unknown	1.5	AR TRM V9
Floor Insulation	R0 to R19	1.61%	SQFT	726	32.2	RTF: ResSFWx_v6_2
	R0 to R25	6.85%	SQFT	1,115	53.9	RTF: ResSFWx_v6_2
	R0 to R30	7.85%	SQFT	1,018	51.7	RTF: ResSFWx_v6_2
Furnace Tune Up	Unknown	0.74%	Unknown	Unknown	14.0	Illinois TRM
HE Water Heater	Not ES, No Gas line Upgrade	0.14%	Efficiency Value	0.91	32.6	RTF: ResGasWH_v3_2
	Not ES, with Gas Line Upgrade	0.57%	Efficiency Value	0.91	32.6	RTF: ResGasWH_v3_2
HE Windows	Single Pane to Class 30	2.08%	Quantity of Windows	146	51.3	RTF: ResSFWx_v6_2
	Single Pane to Class 22	2.77%	Quantity of Windows	4	1.6	RTF: ResSFWx_v6_2
High Efficiency Furnace	CEE Tier 2	7.81%	Efficiency Value	0.95	42.9	RTF: ResESGasFurnaces_v2_1
	CEE Tier 3	6.28%	Efficiency Value	0.97	54.9	RTF: ResESGasFurnaces_v2_1
Hot Water Pipe	Unknown	0.21%	Foot of Insulation	Unknown	2.0	Illinois TRM Table 5.4.1
Infiltration	CFM50 reduction	5.38%	SQFT	1,217	13.9	RTF: ResSFWx_v6_2
Thermal Door	Unknown	0.19%	Unknown	Unknown	22.0	Illinois TRM
Wall	R0 to R11	7.59%	SQFT	694	28.8	RTF: ResSFWx_v6_2

Table 7-2 provides deemed measure savings and effective useful life (EUL) based on average measure efficiency values observed for sampled projects that were part of the document-based verification.

Table 7-59: Deemed Measure Savings (Average Efficiency), TRM-based

Measure	Measure Unit	Measure Unit Average	Unit Energy Savings (Therms)	EUL	EUL Source
Attic/Ceiling Insulation	SQFT	816	74.7	45	RTF
Direct Vent Space Heater	Unknown	Unknown	81.66	20	AR TRM V9
Duct Insulation	SQFT	206	35.8	45	RTF
Duct Sealing	CFM50 reduction	67	44.1	20	RTF
Faucet Aerators	Efficiency Value	Unknown	1.5	10	AR TRM V9
Floor Insulation	SQFT	1,036	45.9	45	RTF
Furnace Tune-Up	Unknown	Unknown	14.0	5	NY TRM V11
HE Water Heater	Efficiency Value	0.91	32.6	15	RTF
HE Windows	Quantity of Windows	150	52.7	25	RTF
High Efficiency Furnace	Efficiency Value	0.96	43.4	20	RTF
Hot Water Pipe Insulation	Foot of Insulation	Unknown	2.0	20	PGW TRM 2023
Infiltration	SQFT	1,217	13.9	15	RTF
Thermal Doors	Unknown	Unknown	22.0	40	RTF
Wall Insulation	SQFT	694	28.8	45	RTF

Table 7-3 provides deemed measure savings resulting from the billing analyses. The regression savings were extrapolated to TMY X data using the latest available years of data (2018-2023). Extrapolating to TMY X ensures that savings are weather normalized to average expected weather in the region[11].

[11] The Evaluators weighted TMY X weather (HDD) by the number of participants belonging to each of the weather stations utilized in the billing analysis.

Table 7-60: Deemed Measure Savings, Billing Analysis

Measure	Measure Unit	Unit Energy Savings (Therms)	Source
Whole-home Cohort (PY2018-PY2022)	Home	104.0	2024 Billing Analysis
High Efficiency Furnace (PY2018-PY2022)	Unit	116.3	2024 Billing Analysis

Appendix C: Data Collection Recommendations

To determine more accurate savings for individual measures in future program years, the Evaluators recommend collecting information detailed in Table 8-1.

In general, the following data collection fields are useful fields to collect for every measure: measure quantity, baseline operating conditions and efficiency values, efficient measure operating conditions and efficiency values, measure descriptions, make and model number for baseline equipment, make and model number for efficient measure equipment, relevant square footage (e.g., whole home, conditioned/unconditioned space, amount installed), heating type, and cooling type.

Table 8-61: Recommended Data Collection Information

Measure	Recommended Data Collection
Ceiling Insulation	Square footage of installed insulation, baseline efficiency and installed efficiency (R-values)
Direct Vent Space Heater	Quantity, make and model number
Duct Insulation	Conditioned square footage of home, baseline efficiency and installed efficiency (R-values), heating and cooling type
Duct Sealing	Measure specification information (e.g., pre/post duct leakage rate), gas furnace efficiency (AFUE)
Faucet Aerators	Quantity, baseline efficiency, installed efficiency
Floor Insulation	Square footage of installed insulation, baseline efficiency, installed efficiency (R-values)
Furnace Tune-Up	Quantity, make and model number, furnace input capacity pre tune-up (Btuh), efficiency of furnace before and after tune-up
HE Water Heater	Quantity, make and model number
HE Windows	Quantity, baseline and efficient window type (e.g., single vs. double pane) baseline and efficient U-values, square footage of area associated with window install
High Efficiency Furnace	Quantity, make and model number
Hot Water Pipe Insulation	Linear footage of installed insulation, thickness of pipe insulation, inside circumference of the pipe, baseline efficiency and installed efficiency (R-values)

Infiltration	Measure specification information (e.g., CFM50 reduction), square footage of affected areas, heating and cooling type
Thermal Doors	Quantity, baseline and efficient door type & installed efficiency (R-Values), square footage of area associated with thermal door install
Wall Insulation	Square footage of installed insulation, baseline efficiency, installed efficiency (R-values)

Appendix D: Survey Collection Instruments

Participant Survey

Table 9-62: Overview of Data Collection Activity

DESCRIPTOR	THIS INSTRUMENT
Instrument Type	Survey
Estimated Time to Complete	10 Mins
Population Description	participants

Table 9-63: Research Objectives

RESEARCH QUESTION FROM PROPOSAL
Is customer service of high quality, timely, and effective?
Are marketing plans implemented per design and effective?
Are program materials effective and complete?
Are rebates/incentives appropriate for meeting program goals?
What are the market barriers that impede program reach?
Is the program reaching the intended hard to reach customers?
Are there remaining customers that qualify for the program have issues or barriers with participating in these programs?

Recruitment Scripts

Email Recruitment (Initial & Reminder 1 & 2)

SUBJECT LINE: NW Natural wants your feedback!

Dear **${e://Field/CONTACT_NAME}**,

NW Natural wants to better understand customers' experience with its energy-efficiency programs, potential barriers to participate in these programs, and general awareness of energy-efficiency offerings. NW Natural is evaluating all of this through ADM Associates (ADM), a national research firm specializing in energy research and program evaluation, which is also the sender of this email.

NW Natural is asking for your help to improve its programs by completing the survey linked below. The survey should take about 10 to 15 minutes to complete, and you will receive a **$10 electronic gift card** as a thank you for your time. Your responses will be completely confidential.

Click the link below to access the survey:

[Survey link]

Or copy and paste the URL below into your internet browser:

[Survey link]

We value your time and feedback. If you have questions or require assistance using the link, please reach out to us at surveyinfo@admenergy.com. If you have questions about how the data will be used, please contact CONTACT AT NW Natural.

Best,

ADM Associates / Contractor to Northwest Natural

Note: ADM conducts research to support research and evaluation in the energy sector. Survey data is not shared with third parties for marketing purposes. Our full privacy statement is available here: admenergy.com/privacy. If you would prefer to opt out of future emailing, follow the link provided: ${l://OptOutLink?d=Click here to unsubscribe}

Survey Instrument

Welcome! Thank you for taking this survey to tell us about your participation in NW Natural's energy-efficiency programs. Your feedback is very important to us and will help us improve programs for our customers. This survey should take 10 to 15 minutes. Your responses are confidential and will be used for research purposes only. If you have questions about how we treat collected data, please see ADM's privacy police at *https://www.admenergy.com/privacy*.

Once you have entered a response for each question, use the arrow at the bottom right of the screen to get to the next question.

Awareness

Our records indicate that you received energy-efficient equipment improvements through NW Natural at **[ADDRESS]**, in collaboration with your local community agency, in 2023. Is that correct? Upgrades may have included a new gas furnace, new insulation, and/or other energy-related improvements.

1. Yes
2. No, I received upgrades BUT my address is incorrect (Please provide correct address) **[OPEN-ENDED]**
3. No, I did not receive any upgrades **[TERMINATE]**

How did you first learn about the NW Natural energy-efficiency program? Select all that apply **[MULTI-SELECT]**

1. NW Natural mailer or bill insert
2. NW Natural website
3. NW Natural email
4. Local Community Action Agency
5. Latino Built
6. African American Alliance for Homeownership (AAAH)
7. Oregon Energy Fund
8. Newspaper or magazine
9. Radio
10. Television
11. Internet search
12. Social media (e.g. Facebook, Instagram, Twitter/X, Tik Tok, etc.)
13. Contractor
14. Word of mouth (friend, family, colleague, neighbor, etc.)
15. Other – please explain **[OPEN-ENDED]**
16. I don’t know

Did you receive any informational brochures or materials about the energy-efficiency program from NW Natural or your local community agency?

1. Yes
2. No

[DISPLAY IF Q3=1]

What type of equipment and/or services did the brochure cover? **[OPEN ENDED]**

[DISPLAY IF Q3=1]

How effective were those materials in getting you to think about purchasing more efficient equipment and/or upgrading your existing equipment? **[SCALE = 1 (NOT AT ALL) TO 5 (EXTREMELY)]**

[DISPLAY IF Q5=4, 5]

What did you find effective about those materials?

How could the materials have been improved to be more effective?

CAP Agency

In this section, we'd like to learn more about your experience working with the community agency that installed your energy-efficiency improvements.

How did you find the community action agency that installed your energy-efficiency improvements?

1. Through a personal contact (friend, family, colleague, neighbor, etc.)
2. Internet search
3. Through another community agency (please describe) **[OPEN ENDED]**
4. Other (please describe) **[OPEN ENDED]**

How did the agency describe the program to you and motivate you to apply? **[OPEN ENDED]**

Before applying for the program, did you have any concerns about the program or the energy-efficiency improvements?

1. Yes
2. No

[DISPLAY if Q10=1]

What were these concerns? **[OPEN ENDED]**

[DISPLAY if Q10=1]

How did the agency address your concerns? **[OPEN ENDED]**

Participation

Why did you decide to participate in the program? **[OPEN ENDED]**

When thinking about making energy-efficiency improvements or purchases, what factors, if any, do you consider when making your decision? **[OPEN ENDED]**

Please rank the following reasons you might consider when making improvements to your home, in order of importance to you:

1. Increase your home's energy efficiency
2. Improve your comfort in your home
3. Improve your health and safety in your home
4. Increase home value

Assessment

As part of your participation in the program, you received an energy assessment of your home. Do you remember receiving this assessment?

1. Yes
2. No
3. I don't remember

[DISPLAY IF Q16=1]

After the assessment, did the assessor provide you with a list of findings and recommendations for home improvements?

1. Yes
2. No
3. I don't remember

[DISPLAY IF Q16=1]

Were there any recommendations from your assessment that you **DID NOT** act on?

1. Yes. Please explain **[OPEN ENDED]**

2. No

3. I don't remember

[DISPLAY IF Q19=1]

Why did you choose not to act on those recommendations? **[OPEN ENDED]**

[DISPLAY IF Q16=1]

How satisfied are you with each of the following? **SCALE: 1=STRONGLY DISSATISFIED, 2=SOMEWHAT DISSATISFIED, 3=NEITHER SATISFIED NOR DISSATISFIED, 4=SOMEWHAT SATISFIED, 5=STRONGLY SATISFIED]**

1. The professionalism of the assessor

2. The thoroughness of the assessment

3. The recommendations provided in the assessment

4. The assessment overall

[DISPLAY IF Q20<3]

You indicated some dissatisfaction, please explain. **[OPEN-ENDED]**

Contractor

In this section, we will ask you about your experience with the contractor who made the energy-efficiency improvements to your home.

How did you find the contractor who installed the energy-efficiency improvements?

1. NW Natural representative referred me to the contractor

2. Community agency representative referred me to the contractor

3. The contractor was someone I've worked with before

4. Through a personal contact (friend, family, colleague, neighbor, etc.)

5. Internet search

6. Other – please describe **[OPEN-ENDED]**

7. I don't know

Please rate your agreement with the following statements regarding your experience with your contractor **[SCALE: 1=STRONGLY DISAGREE, 2=SOMEWHAT DISAGREE, 3=NEITHER AGREE NOR DISAGREE, 4=SOMEWHAT AGREE, 5=STRONGLY AGREE]**

1. The contractor was courteous

2. The contractor was professional

3. The work was scheduled in a reasonable amount of time

3. The time it took to complete the work was reasonable

[DISPLAY IF Q23<3]

You indicated some disagreement. Why do you disagree? **[OPEN-ENDED]**

Equipment

Next, we would like to confirm the type of equipment you received from the energy-efficiency program.

NW Natural records say that you received the following equipment and/or improvements. Is this correct? **[OPTIONS: Yes, No, Don't know]**

1. Heating and cooling equipment (e.g. furnace, fireplace, HVAC system)

2. Thermostat(s)

3. Weatherization improvements (insulation, duct sealing, etc.)

4. Other – please specify **[OPEN-ENDED]**

Are these improvements still installed and working?

1. Yes

2. No

[DISPLAY IF Q26=2]

What happened to the improvements that are no longer installed and/or working? **[OPEN ENDED]**

Were there additional energy-efficiency improvements you wanted, but did not receive? Please describe.

1. No

2. Yes **[OPEN ENDED]**

Satisfaction

In this section, we will ask about your overall satisfaction with the program.

Please rate your level of satisfaction with the following **[SCALE: 1=NOT AT ALL SATISIFED, 2=SOMEWHAT DISSATISFIED, 3=NEITHER SATISFIED NOR DISSATISFIED, 4=SOMEWHAT SATISFIED, 5=VERY SATISFIED]**

1. The amount of the rebate you received

2. The time it took to receive your rebate

3. Your experience with the program overall

5. NW Natural as your natural gas provider

[DISPLAY IF Q29<3]

You expressed some dissatisfaction. Why are you dissatisfied? **[OPEN-ENDED]**

Would you say that your participation in the energy-efficiency program has…

1. Greatly decreased your satisfaction with NW Natural

2. Somewhat decreased your satisfaction NW Natural

4. Somewhat increased your satisfaction with NW Natural

5. Greatly increased your satisfaction with NW Natural

How likely are you to recommend the energy-efficiency program to others?

1. Not at all likely

2. Somewhat likely

3. Moderately likely

4. Very likely

5. Extremely likely

How trustworthy is NW Natural as a source of information about saving energy in your home?

1. Not at all trustworthy
2. Somewhat trustworthy
3. Moderately trustworthy
4. Very trustworthy
5. Extremely trustworthy

Is there any other feedback you would like to provide to NW Natural and/or the community agency you worked with?

1. No
2. Yes **[OPEN ENDED]**

Demographics and Residence Characteristics

This last set of questions are about your home.

Do you rent or own your home?

1. Own
2. Rent
3. Own, and rent out to someone else
4. Prefer not to answer

Which of the following best describes your home?

1. Single-family home
2. Manufactured or mobile home
3. Duplex or townhome
4. Apartment or condominium
5. Other – please specify **[OPEN-ENDED]**
4. Prefer not to answer

Approximately when was your home built?

1. Before 1960
2. 1960 to 1979
3. 1980 to 1989
4. 1990 to 1999
5. 2000 to 2009
6. 2010 or later
7. I don't know
8. Prefer not to answer

About how many square feet is your home? If you are unsure, an estimate is okay.

1. Less than 1,000 square feet
2. 1,000 to 1,999 square feet
3. 2,000 to 2,999 square feet
4. 3,000 to 3,999 square feet
5. 4,000 square feet or more
6. I don't know
7. Prefer not to answer

What is your age?

1. 18 to 24
2. 25 to 34
3. 35 to 44
4. 45 to 54
5. 55 to 64
6. 65 to 74
7. 75+
8. Prefer not to answer

Which of the following best describes you? Please select all that apply **[MULTI-SELECT]**

1. American Indian or Alaska Native
2. East Asian (e.g. Chinese, Filipino, Asian Indian, Vietnamese, Korean, Japanese)
3. South Asian (e.g. Asian Indian, Pakistani, Bangladeshi)
4. Black or African American
5. Hispanic, Latino or Spanish origin
6. Native Hawaiian or Pacific Islander
7. Middle Eastern or North African
8. White or Caucasian
9. A race, ethnicity or origin not listed above– please specify **[OPEN-ENDED]**
10. Prefer not to answer

What is the highest level of education you have completed?

1. High school graduate or GED
2. Associates degree, vocational/technical school, or college
3. Four-year college degree
4. Graduate or professional degree

98. I don't know
99. Prefer not to answer

What county do you live in?

1. Benton, OR
2. Clackamas, OR
3. Clatsop, OR
4. Columbia, OR
5. Coos, OR
6. Hood River, OR
7. Lane, OR
8. Lincoln, OR

9. Linn, OR
10. Marion-Polk, OR
11. Multnomah, OR
12. Washington, OR
13. Yamhill, OR
14. Clark, WA

Including yourself, how many people live in your home year-round?

1. 1 person
2. 2 people
3. 3 people
4. 4 people
5. 5 people
6. 6 people
7. 7 people
8. 8 or more people
9. Prefer not to answer

Including all money earned from wages, salaries, tips, commissions, workers' compensation, unemployment insurance, child support, or other sources, did your household make more than the following amount of money in 2023?
[MATRIX OPTIONS: The same amount or less, More, I don't know]

1. **IF Benton, OR** -- $108,000
2. **IF Clackamas, OR** -- $118,000
3. **IF Clatsop, OR** -- $92,300
4. **IF Columbia, OR** -- $118,000
5. **IF Coos, OR** -- $80,900

6. **IF Hood River, OR** -- $97,900

7. **IF Lane, OR** – $89,100

8. **IF Lincoln, OR** -- $80,900

9. **IF Linn, OR** -- $84,900

10. **IF Marion-Polk, OR** -- $91,300

11. **IF Multnomah, OR** -- $118,000

12. **IF Washington, OR** -- $118,000

13. **IF Yamhill, OR** -- $118,00

14. **IF Clark, WA** -- $94,400

Thank You!

Thank you for taking time today to complete this survey. As stated in the email, we are providing a **$10 electronic gift card** as a thank you for your responses. You should receive this gift card in the next 3 to 5 business days; the email will be from Tango Rewards. The email address we have on file for you is **[EMAIL]**. Please confirm this information.

1. Yes, please send my electronic gift card to the above email address

2. No, please send my electronic gift card to the following email address **[OPEN-ENDED]**

Non-Participant Survey

Table 9-64 Overview of Data Collection Activity

DESCRIPTOR	THIS INSTRUMENT
Instrument Type	Survey
Estimated Time to Complete	10 Mins
Population Description	Nonparticipants

Table 9-65 Research Objectives

RESEARCH QUESTION FROM PROPOSAL
Is customer service of high quality, timely, and effective?

Are marketing plans implemented per design and effective?
Are program materials effective and complete?
Are rebates/incentives appropriate for meeting program goals?
What are the market barriers that impede program reach?
Is the program reaching the intended hard to reach customers?
Are there remaining customers that qualify for the program have issues or barriers with participating in these programs?

Recruitment Scripts

Email Recruitment (Initial & Reminder 1 & 2)

SUBJECT LINE: NW Natural wants your feedback!

Dear **${e://Field/CONTACT_NAME}**,

NW Natural hired ADM Associates, an independent research and evaluation firm, to gather feedback about its services and programs from residential customers like you. We would like to hear from 200 people by **[DATE TBD]**. Can you be one of those who help us reach that goal by answering a few quick questions about your experience with NW Natural? The survey should take about **10 minutes**. After you complete the survey, we will send you a **$10 e-gift card** that can be used at a variety of retailers as our way of saying thanks.

Your responses will be kept anonymous and completely confidential.

Click the link below to access the survey:

[Survey link]

Or copy and paste the URL below into your internet browser:

[Survey link]

We value your time and feedback. If you have questions or require assistance using the link, please reach out to us at surveyinfo@admenergy.com. If you have questions about how the data will be used, please contact CONTACT AT NW NATURAL.

Kind Regards,

ADM Associates / Contractor to NW Natural

Note: ADM conducts research to support research and evaluation in the energy sector. Survey data is not shared with third parties for marketing purposes. Our full privacy statement is available here: admenergy.com/privacy. If you would prefer to opt out of future emailing, follow the link provided: ${l://OptOutLink?d=Click here to unsubscribe}

Survey Instrument

Introduction

Thank you for agreeing to provide your feedback about your experience with NW Natural's services and programs. To start, we have a few questions about your awareness of NW Natural's programs and services. Your feedback is very important to us and will help us improve programs for customers like you. This survey should take 10-15 minutes.

Your responses are confidential and will be used for research purposes only. If you have questions about how we treat collected data, please see ADM's privacy policy at admenergy.com/privacy.

Screening

According to our records, NW Natural provides natural gas to your residence at [ADDRESS]. Is that correct?

1. Yes
2. Yes, but address is incorrect **[OPEN-ENDED: CORRECT ADDRESS]**
3. No **[TERMINATE]**

We understand that it is not always possible to make improvements to your home. Which of the following best describes your authority to make decisions?

1. No authority – as a renter, I am not allowed to make improvements **[TERMINATE]**
2. Some authority – as a renter, I am allowed to make some improvements
3. Full authority – I am the owner
4. Full authority – as part of my rental agreement, I am required to maintain/repair the home

To the best of your knowledge, have you replaced or upgraded equipment that requires gas, in the last three years? This could have been heating/cooling equipment, weatherization improvements (eg. insulation, duct sealing, etc.), or water heating equipment.

1. Yes
2. No
3. I don't know

[DISPLAY IF Q3=1]

What types of equipment or improvements did you replace in the last three years? Select all that apply **[MULTI-SELECT]**

1. Heating and cooling equipment (e.g. furnace, fireplace, HVAC system)
2. Efficient appliances (e.g. washer, dryer, range)
3. Thermostat(s)
4. Weatherization improvements (e.g. insulation, duct sealing, etc.)
5. Water heating equipment
7. Other – please specify [OPEN-ENDED]

[DISPLAY IF Q3=1]

Did you receive an incentive from NW Natural for any of that equipment?

1. Yes **[SKIP TO END, TERMINATE]**
2. No
3. Don't know

Have you participated in a NW Natural-sponsored bill assistance program?

1. Yes
2. No

Why haven't you participated in any of NW Natural's programs? Select all that apply **[MULTI-SELECT]**

1. I have not needed to replace any of my gas equipment or make weatherization improvements

2. I did not know enough about the programs and incentives

3. Energy savings from the equipment replacements or improvements was not worth the trouble

4. Too much time or trouble to receive the incentives

5. Prefer not to work with NW Natural

6. Incentives are not high enough to offset the cost of high-efficiency equipment, compared to standard-efficiency equipment

7. I am financially able to make the improvements without the incentives

8. I don't have the authority to participate in any NW Natural programs

9. Other – please specify **[OPEN-ENDED]**

10. I don't know

Program Awareness

[ASK ALL]

Before today, had you heard that NW Natural offers a weatherization (e.g. insulation, duct sealing, air sealing, etc.) and furnace-replacement program in collaboration with local community agencies?

1. Yes

2. No

[ASK IF Q9 =1, Yes]

How did you learn about NW Natural's weatherization and furnace-replacement offerings? **[OPEN-ENDED]**

1. Mailed information from NW Natural

2. Email from NW Natural

3. NW Natural program staff

4. NW Natural website

5. Community agency representative

6. Community-based organization representative

7. Newspaper or magazine article or advertisement

8. Contractor

9. Word of mouth from a personal contact (e.g., family member, friend, neighbor, colleague, etc.)

10. Radio advertisement

11. Another website

12. Social media (e.g. Facebook, Instagram, Twitter, Tik Tok, etc.)

13. Information at a retailer

14. Other, please specify: _____

[DISPLAY IF Q9=1]

What programs or services were you already aware of? Select all that apply **[MULTI-SELET]**

1. Bill assistance programs

2. Incentives for heating and cooling equipment (e.g. furnaces, fireplaces, HVAC systems)

3. Incentives for building shell improvements and weatherization (e.g. pipe wrap insulation, attic insulation)

4. Incentives for water heating equipment

5. Incentives for smart/programmable thermostats

6. Incentives for efficient appliances (e.g. washer, dryer, range)

7. Other – please specify **[OPEN-ENDED]**

8. I don’t remember

Are you interested in making energy-efficiency improvements and participating in a NW Natural energy-efficiency program?

1. Yes

2. No

[DISPLAY IF Q12=1]

What energy-efficiency improvements or programs are you interested in? Select all that apply **[MULTI-SELECT]**

1. Heating/cooling equipment

2. Water heating equipment

3. Smart/programmable thermostats

4. Efficient appliances (e.g. washer, dryer, range)

5. Home weatherization (e.g. pipe wrap insulation, attic insulation, insulated door)

6. Other – please specify **[OPEN-ENDED]**

[DISPLAY IF Q12=1]

How soon do you plan to replace the equipment?

1. In the next year
2. In the next 1-2 years
3. In the next 2-4 years
4. More than 4 years from now
5. I don't know

Participation Barriers

On a scale of 1 through 5, where 1 means "not at all interested" and 5 means "very interested", how interested are you in participating in NW Natural's energy-efficiency programs?

1. 1 – Not at all interested

2. 2

3. 3

4. 4

5. 5 – Very interested

What might prevent you from participating in a NW Natural's program? **[OPEND ENDED]**

Are there any changes NW Natural can make to its programs to encourage you to participate? **[OPEN ENDED]**

End Uses

What do you think is the largest energy user in your home?

1. Heating/cooling equipment
2. Water heating equipment
3. Appliances (clothes washer/dryer, range, etc.)
4. Refrigeration
5. Other – please specify **[OPEN-ENDED]**

What type of heating system do you currently have in your home?

1. Gas furnace
2. Gas fireplace
3. Heat Pump
4. Mini split
5. Electric resistance (e.g. baseboard)
6. I don't heat the home
7. I don't know

What is the main fuel used to heat your home?

1. Electricity
2. Natural Gas
3. Propane
4. Other, please specify: _____
5. I don't heat my home
6. I don't know
7. Prefer not to answer

[SKIP IF 0=5 OR 98]

Approximately how old is the heating system?

1. Less than 10 years old
2. 10 to 20 years old
3. More than 20 years old
4. I don't know

When was the last time your heating system was serviced?

1. Less than 1 year ago
2. 1 to 3 years ago
3. More than 3 years ago
4. It's never been serviced
5. I don't know

What type of thermostat do you use?

1. Manual
2. Programmable
3. Smart thermostat

4. I don’t know

Demographics

This last set of questions will help NW Natural develop more effective programs that may best serve the needs of the community. Your answers will remain anonymous, so no information will be linked with you or your household. You may choose “Prefer not to answer.”

Do you own or rent the home at **${e://Field/ADDRESS}**?

1. Own
2. Rent
3. Own and rent to someone else
4. Prefer not to answer

[DISPLAY IF Q24 = 1 OR 3]

When was your home built?

1. Before 1950
2. 1950 to 1959
3. 1960 to 1969
4. 1970 to 1979
5. 1980 to 1989
6. 1990 to 1999
7. 2000 to 2009
8. 2010 to 2019
9. 2020 to Present
10. I don’t know
11. Prefer not to answer

Which best describes your home?

1. Single-family house detached

2. Single-family house attached to one or more other houses (e.g., duplex, condominium, townhouse, etc.)

3. Mobile or manufactured home

4. Apartment with 2 to 4 units

5. Apartment with 5 or more units

6. Other, please specify: _____

7. Prefer not to answer

What county do you live in?

1. Benton, OR
2. Clackamas, OR
3. Clatsop, OR
4. Columbia, OR
5. Coos, OR
6. Hood River, OR
7. Lane, OR
8. Lincoln, OR
9. Linn, OR
10. Marion-Polk, OR
11. Multnomah, OR
12. Washington, OR
13. Yamhill, OR
14. Clark, WA

Including yourself, how many people live in your home year-round?

1. 1 person
2. 2 people
3. 3 people
4. 4 people
5. 5 people
6. 6 people
7. 7 people
8. 8 or more people
9. Prefer not to answer

Including all money earned from wages, salaries, tips, commissions, workers' compensation, unemployment insurance, child support, or other sources, did your household make more than the following amount of money in 2023? **[MATRIX OPTIONS: The same amount or less, More, I don't know]**

1. **IF Benton, OR** -- $108,000
2. **IF Clackamas, OR** -- $118,000
3. **IF Clatsop, OR** -- $92,300
4. **IF Columbia, OR** -- $118,000
5. **IF Coos, OR** -- $80,900
6. **IF Hood River, OR** -- $97,900
7. **IF Lane, OR** – $89,100
8. **IF Lincoln, OR** -- $80,900
9. **IF Linn, OR** -- $84,900
10. **IF Marion-Polk, OR** -- $91,300
11. **IF Multnomah, OR** -- $118,000
12. **IF Washington, OR** -- $118,000
13. **IF Yamhill, OR** -- $118,00

14. **IF Clark, WA** -- $94,400

What is the highest level of education you have completed?

1. Did not graduate high school
2. High school graduate
3. Associates degree, vocation/ technical school, or some college
4. Four-year college degree
5. Graduate or professional degree
6. Prefer not to answer

Customer Information and Thank You Page

This is the end of the survey. As a thank you for your time answering our questions, NW Natural would like to provide you with a $10 MasterCard gift card.

The email address we have for you is **${e://Field/RecipientEmail}**. Please let us know if you would like us to send your electronic gift card to this address or a different address.

1. Please send my electronic gift card to the **above** email address
2. Please send my electronic gift card to the **following** email address:

_____