

APPENDIX

Appendix A: Cost-effectiveness Results¹

¹ Cost-effectiveness results were generated by Applied Energy Group (AEG) using the approved Cost-effectiveness methodologies.



MEMORANDUM

To: Alesha Pino, PacifiCorp
From: Andrew Cottrell, Andy Hudson, Dylan Royalty, AEG
Date: April 27, 2022
Re: PacifiCorp Washington Portfolio and Sector Level Cost-Effectiveness Results – PY2021

AEG estimated the cost-effectiveness of PacifiCorp's overall energy efficiency portfolio in the state of Washington based on Program Year (PY) 2021 costs and savings¹ estimates provided by PacifiCorp. This memo provides cost-effectiveness results at the portfolio and sector levels. The portfolio passes the following cost effectiveness tests: Total Resource Cost Test (TRC), the PacifiCorp Total Resource Cost Test (PTRC), the Utility Cost Test (UCT), and the Participant Cost Test (PCT).

This memo provides analysis inputs and results in the following tables:

Table 1: Cost-Effectiveness Analysis Inputs

Table 2: Portfolio Level Costs, Nominal - PY2021

Table 3: NEEA Inputs - PY2021

Table 4: Benefit/Cost Ratios by Portfolio Type

Table 5: 2021 Total Portfolio Cost-Effectiveness Results

Table 6: 2021 Total Portfolio Cost-Effectiveness Results (Including NEEA)

Table 7: 2021 Total Portfolio Cost-Effectiveness Results (Including NEIs)

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Table 9: 2021 Wattsmart Business Energy Efficiency Sector Cost-Effectiveness Results

Table 10: 2021 Wattsmart Business Energy Efficiency Sector Cost-Effectiveness Results (Including NEEA)

Table 11: 2021 Wattsmart Business Energy Efficiency Sector Cost-Effectiveness Results (Including NEIs)

¹ The commercial line loss factor was used for all Wattsmart Business savings; commercial sector savings represent approximately 74% of total program savings.



Table 12: 2021 Wattsmart Business Energy Efficiency Sector Cost-Effectiveness Results (Including NEEA & NEIs)

Table 13: 2021 Residential Energy Efficiency Sector Cost-Effectiveness Results

Table 14: 2021 Residential Energy Efficiency Sector Cost-Effectiveness Results (Including NEEA)

Table 15: 2021 Residential Energy Efficiency Sector Cost-Effectiveness Results (Including NEIs)

Table 16: 2021 Residential Energy Efficiency Sector Cost-Effectiveness Results (Including NEEA & NEIs)

Table 17: 2021 Residential Non-Energy Impacts by Measure Category

Table 18: 2021 Wattsmart Business Non-Energy Impacts by Measure

The following assumptions were utilized in the analysis:

- **Avoided Costs:** derived from PacifiCorp’s 2021 Integrated Resource Plan (IRP) Preferred Portfolio “PO2-MM-CETA”, converted into annual values using load shapes from the same IRP.
- **Modeling Inputs:** measure savings, costs, non-energy impacts (NEIs), measure lives, incentive levels, program delivery, and portfolio costs were based on estimates provided by PacifiCorp.
- **Net-to-Gross (NTG):** ratios are assumed to be 1.0, consistent with condition (8)(a) to Order 01 in Docket UE-152072.
- **Retail Rates:** 2021 rates provided by PacifiCorp and escalated by inflation for future years.

Tables 1 and 2 below summarize cost-effectiveness assumptions for the PacifiCorp Washington energy efficiency portfolio. All costs and impacts are presented at the portfolio level. Table 3 provides the savings and costs assumptions for NEEA.

Table 1: Cost-Effectiveness Analysis Inputs

Parameter	PY2021
Discount Rate	6.92%
Residential Line Loss	7.68%
Commercial Line Loss	7.60%
Residential Energy Rate (\$/kWh)	\$0.0828
Commercial Energy Rate (\$/kWh)	\$0.0809
Industrial Energy Rate (\$/kWh)	\$0.0666
Irrigation Energy Rate (\$/kWh)	\$0.0890
Inflation Rate	2.28%



Table 2: Portfolio Level Costs, Nominal - PY2021²

Portfolio Level Expense	Cost
Be Wattsmart, Begin at Home	\$48,700
Outreach and Communication	\$245,986
Program Evaluations	\$317,623
Potential Study	\$45,383
System Support	\$31,110
End Use Research	\$12,620
Total	\$701,422

Table 3: NEEA Inputs - PY2021

Sector	Savings at Meter (kWh)	Expenses (\$)
Residential	2,678,008	\$422,550
Commercial	1,842,926	\$361,356
Industrial	66,724	\$8,614
Total	4,587,659	\$792,520

Tables 4 through 16 present the cost-effectiveness results at the portfolio and sector levels. Tables 17 and 18 present the NEI impacts for the residential and commercial sectors by measure category.

Table 4: Benefit/Cost Ratios by Portfolio Type

Program	PTRC	TRC	UCT	PCT	RIM
Total Portfolio	1.75	1.60	1.92	3.17	0.76
Total Portfolio with NEEA	2.16	1.97	2.34	3.93	0.82
Total Portfolio with NEIs	1.78	1.62	1.92	3.23	0.76
Total Portfolio with NEEA and NEIs	2.19	1.99	2.34	3.98	0.82
Wattsmart Business	2.55	2.32	2.85	3.96	0.87
Wattsmart Business with NEEA	2.71	2.47	2.99	4.36	0.88
Wattsmart Business with NEIs	2.56	2.32	2.85	3.97	0.87
Wattsmart Business with NEEA and NEIs	2.72	2.47	2.99	4.37	0.88
Residential	0.86	0.78	0.95	1.87	0.55
Residential with NEEA	1.67	1.52	1.81	3.20	0.77
Residential with NEIs	0.92	0.85	0.95	2.00	0.55
Residential with NEEA and NEIs	1.73	1.58	1.81	3.34	0.77

² To align with annual budget expectations, cost-effectiveness inputs are presented in nominal dollars.



Table 5: 2021 Total Portfolio Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0670	\$12,921,531	\$22,675,091	\$9,753,560	1.75
Total Resource Cost Test (TRC) No Adder	\$0.0670	\$12,921,531	\$20,613,719	\$7,692,188	1.60
Utility Cost Test (UCT)	\$0.0556	\$10,721,659	\$20,613,719	\$9,892,060	1.92
Participant Cost Test (PCT)		\$6,487,417	\$20,578,515	\$14,091,098	3.17
Rate Impact Test (RIM)		\$27,012,629	\$20,613,719	-\$6,398,910	0.76
Lifecycle Revenue Impacts (\$/kWh)					\$0.0004720
Discounted Participant Payback (years)					3.04

Table 6: 2021 Total Portfolio Cost-Effectiveness Results (Including NEEA)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0555	\$13,714,051	\$29,643,776	\$15,929,725	2.16
Total Resource Cost Test (TRC) No Adder	\$0.0555	\$13,714,051	\$26,948,888	\$13,234,836	1.97
Utility Cost Test (UCT)	\$0.0466	\$11,514,179	\$26,948,888	\$15,434,709	2.34
Participant Cost Test (PCT)		\$6,487,417	\$25,469,618	\$18,982,202	3.93
Rate Impact Test (RIM)		\$32,696,253	\$26,948,888	-\$5,747,365	0.82
Lifecycle Revenue Impacts (\$/kWh)					\$0.0005713
Discounted Participant Payback (years)					2.71

Table 7: 2021 Total Portfolio Cost-Effectiveness Results (Including NEIs)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0670	\$12,921,531	\$23,018,583	\$10,097,052	1.78
Total Resource Cost Test (TRC) No Adder	\$0.0670	\$12,921,531	\$20,957,211	\$8,035,680	1.62
Utility Cost Test (UCT)	\$0.0556	\$10,721,659	\$20,613,719	\$9,892,060	1.92
Participant Cost Test (PCT)		\$6,487,417	\$20,922,007	\$14,434,590	3.23
Rate Impact Test (RIM)		\$27,012,629	\$20,613,719	-\$6,398,910	0.76
Lifecycle Revenue Impacts (\$/kWh)					\$0.0004720
Discounted Participant Payback (years)					3.04



Table 8: 2021 Total Portfolio Cost-Effectiveness Results (Including NEEA & NEIs)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0555	\$13,714,051	\$29,987,269	\$16,273,217	2.19
Total Resource Cost Test (TRC) No Adder	\$0.0555	\$13,714,051	\$27,292,380	\$13,578,329	1.99
Utility Cost Test (UCT)	\$0.0466	\$11,514,179	\$26,948,888	\$15,434,709	2.34
Participant Cost Test (PCT)		\$6,487,417	\$25,813,111	\$19,325,694	3.98
Rate Impact Test (RIM)		\$32,696,253	\$26,948,888	-\$5,747,365	0.82
Lifecycle Revenue Impacts (\$/kWh)					\$0.0005713
Discounted Participant Payback (years)					2.71

Table 9: 2021 Wattsmart Business Energy Efficiency Sector Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0453	\$7,172,675	\$18,317,211	\$11,144,536	2.55
Total Resource Cost Test (TRC) No Adder	\$0.0453	\$7,172,675	\$16,652,010	\$9,479,335	2.32
Utility Cost Test (UCT)	\$0.0369	\$5,850,068	\$16,652,010	\$10,801,942	2.85
Participant Cost Test (PCT)		\$4,041,937	\$16,010,995	\$11,969,058	3.96
Rate Impact Test (RIM)		\$19,141,733	\$16,652,010	-\$2,489,723	0.87
Lifecycle Revenue Impacts (\$/kWh)					\$0.0004668
Discounted Participant Payback (years)					2.67

Table 10: 2021 Wattsmart Business Energy Efficiency Sector Cost-Effectiveness Results (Including NEEA)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0425	\$7,542,645	\$20,462,224	\$12,919,579	2.71
Total Resource Cost Test (TRC) No Adder	\$0.0425	\$7,542,645	\$18,602,022	\$11,059,377	2.47
Utility Cost Test (UCT)	\$0.0350	\$6,220,038	\$18,602,022	\$12,381,984	2.99
Participant Cost Test (PCT)		\$4,041,937	\$17,634,220	\$13,592,283	4.36
Rate Impact Test (RIM)		\$21,134,928	\$18,602,022	-\$2,532,907	0.88
Lifecycle Revenue Impacts (\$/kWh)					\$0.0006107
Discounted Participant Payback (years)					2.48



Table 11: 2021 Wattsmart Business Energy Efficiency Sector Cost-Effectiveness Results (Including NEIs)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0453	\$7,172,675	\$18,339,649	\$11,166,974	2.56
Total Resource Cost Test (TRC) No Adder	\$0.0453	\$7,172,675	\$16,674,448	\$9,501,773	2.32
Utility Cost Test (UCT)	\$0.0369	\$5,850,068	\$16,652,010	\$10,801,942	2.85
Participant Cost Test (PCT)		\$4,041,937	\$16,033,433	\$11,991,496	3.97
Rate Impact Test (RIM)		\$19,141,733	\$16,652,010	-\$2,489,723	0.87
Lifecycle Revenue Impacts (\$/kWh)					\$0.0004668
Discounted Participant Payback (years)					2.67

Table 12: 2021 Wattsmart Business Energy Efficiency Sector Cost-Effectiveness Results (Including NEEA & NEIs)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0425	\$7,542,645	\$20,484,662	\$12,942,017	2.72
Total Resource Cost Test (TRC) No Adder	\$0.0425	\$7,542,645	\$18,624,460	\$11,081,815	2.47
Utility Cost Test (UCT)	\$0.0350	\$6,220,038	\$18,602,022	\$12,381,984	2.99
Participant Cost Test (PCT)		\$4,041,937	\$17,656,659	\$13,614,722	4.37
Rate Impact Test (RIM)		\$21,134,928	\$18,602,022	-\$2,532,907	0.88
Lifecycle Revenue Impacts (\$/kWh)					\$0.0006107
Discounted Participant Payback (years)					2.48

Table 13: 2021 Residential Energy Efficiency Sector Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1464	\$5,060,054	\$4,357,880	-\$702,174	0.86
Total Resource Cost Test (TRC) No Adder	\$0.1464	\$5,060,054	\$3,961,709	-\$1,098,345	0.78
Utility Cost Test (UCT)	\$0.1210	\$4,182,789	\$3,961,709	-\$221,080	0.95
Participant Cost Test (PCT)		\$2,445,480	\$4,567,521	\$2,122,041	1.87
Rate Impact Test (RIM)		\$7,182,095	\$3,961,709	-\$3,220,386	0.55
Lifecycle Revenue Impacts (\$/kWh)					\$0.0001255
Discounted Participant Payback (years)					3.92



Table 14: 2021 Residential Energy Efficiency Sector Cost-Effectiveness Results (Including NEEA)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0788	\$5,482,604	\$9,181,552	\$3,698,948	1.67
Total Resource Cost Test (TRC) No Adder	\$0.0788	\$5,482,604	\$8,346,866	\$2,864,262	1.52
Utility Cost Test (UCT)	\$0.0662	\$4,605,339	\$8,346,866	\$3,741,527	1.81
Participant Cost Test (PCT)		\$2,445,480	\$7,835,398	\$5,389,918	3.20
Rate Impact Test (RIM)		\$10,872,522	\$8,346,866	-\$2,525,656	0.77
Lifecycle Revenue Impacts (\$/kWh)					\$0.0003806
Discounted Participant Payback (years)					3.19

Table 15: 2021 Residential Energy Efficiency Sector Cost-Effectiveness Results (Including NEIs)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1464	\$5,060,054	\$4,678,934	-\$381,121	0.92
Total Resource Cost Test (TRC) No Adder	\$0.1464	\$5,060,054	\$4,282,763	-\$777,292	0.85
Utility Cost Test (UCT)	\$0.1210	\$4,182,789	\$3,961,709	-\$221,080	0.95
Participant Cost Test (PCT)		\$2,445,480	\$4,888,574	\$2,443,094	2.00
Rate Impact Test (RIM)		\$7,182,095	\$3,961,709	-\$3,220,386	0.55
Lifecycle Revenue Impacts (\$/kWh)					\$0.0002514
Discounted Participant Payback (years)					3.92

Table 16: 2021 Residential Energy Efficiency Sector Cost-Effectiveness Results (Including NEEA & NEIs)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0788	\$5,482,604	\$9,502,606	\$4,020,002	1.73
Total Resource Cost Test (TRC) No Adder	\$0.0788	\$5,482,604	\$8,667,920	\$3,185,315	1.58
Utility Cost Test (UCT)	\$0.0662	\$4,605,339	\$8,346,866	\$3,741,527	1.81
Participant Cost Test (PCT)		\$2,445,480	\$8,156,452	\$5,710,972	3.34
Rate Impact Test (RIM)		\$10,872,522	\$8,346,866	-\$2,525,656	0.77
Lifecycle Revenue Impacts (\$/kWh)					\$0.0002989
Discounted Participant Payback (years)					3.19



Table 17: 2021 Residential Non-Energy Impacts by Measure Category

Measure	Annual NEIs	Quantity	Measure Life	Total Present Value NEIs
Appliances	\$1,395	89	14	13,110
Building Shell	\$195	106,925	45	2,867
Energy Kits	\$19	25	9	133
HVAC	\$15,133	1,380	17	158,848
Lighting	\$32,980	169,766	4	144,894
Whole Home	\$87	22	33	1,202
Total	\$49,810	278,207	15	\$321,054

Table 18: 2021 Wattsmart Business Non-Energy Impacts by Measure

Measure	Annual NEIs	Quantity	Measure Life	Total Present Value NEIs
Irrigation	\$2,631	1,919	11	\$22,439
Total	\$2,631	1,919	11	\$22,439



MEMORANDUM

To: Alesha Pino, PacifiCorp
From: Andrew Cottrell, Andy Hudson, Dylan Royalty, AEG
Date: April 27, 2022
Re: PacifiCorp Washington Home Energy Savings Cost-Effectiveness Results – PY2021

AEG estimated the cost-effectiveness of PacifiCorp's overall energy efficiency portfolio in the state of Washington based on Program Year (PY) 2021 costs and savings estimates provided by PacifiCorp. This memo provides cost-effectiveness results for the Home Energy Savings program. The program passes the Participant Cost Test (PCT).

This memo provides analysis inputs and results in the following tables:

Table 1: Cost-Effectiveness Analysis Inputs

Table 2: Annual Program Level Costs, Nominal - PY2021

Table 3: Annual Savings - PY2021

Table 4: Benefit/Cost Ratios by Measure Category

Table 5: 2021 Home Energy Savings Program Cost-Effectiveness Results

Table 6: 2021 Home Energy Savings Appliances Cost-Effectiveness Results (Load Shape - Residential_ERWH_7P)

Table 7: 2021 Home Energy Savings Building Shell Cost-Effectiveness Results (Load Shape - WA_Single_Family_Heat_pump)

Table 8: 2021 Home Energy Savings Home Energy Kit Cost-Effectiveness Results (Load Shape - Residential_ERWH_7P)

Table 9: 2021 Home Energy Savings HVAC Cost-Effectiveness Results (Load Shape - WA_Single_Family_Heat_pump)

Table 10: 2021 Home Energy Savings Lighting Cost-Effectiveness Results (Load Shape - Residential_LIGHTING_7P)

Table 11: 2021 Home Energy Savings Water Heating Cost-Effectiveness Results (Load Shape - Residential_HPWH_7P)



Table 12: 2021 Home Energy Savings Whole Home Cost-Effectiveness Results (Load Shape - WA_Single_Family_Heat_pump)

Table 13: 2021 Home Energy Savings Coupons Cost-Effectiveness Results (Load Shape - WA_Single_Family_Heat_pump)

Table 14: 2021 Home Energy Savings Non-Energy Impacts by Measure Category

Table 15: 2021 Home Energy Savings Program Cost-Effectiveness Results (Including NEIs)

Table 16: 2021 Home Energy Savings Appliances Cost-Effectiveness Results (Including NEIs) (Load Shape - Residential_ERWH_7P)

Table 17: 2021 Home Energy Savings Building Shell Cost-Effectiveness Results (Including NEIs) (Load Shape - WA_Single_Family_Heat_pump)

Table 18: 2021 Home Energy Savings Home Energy Kit Cost-Effectiveness Results (Including NEIs) (Load Shape - Residential_ERWH_7P)

Table 19: 2021 Home Energy Savings HVAC Cost-Effectiveness Results (Including NEIs) (Load Shape - WA_Single_Family_Heat_pump)

Table 20: 2021 Home Energy Savings Lighting Cost-Effectiveness Results (Including NEIs) (Load Shape - Residential_LIGHTING_7P)

Table 21: 2021 Home Energy Savings Whole Home Cost-Effectiveness Results (Including NEIs) (Load Shape - WA_Single_Family_Heat_pump)

The following assumptions were utilized in the analysis:

- **Avoided Costs:** derived from PacifiCorp's 2021 Integrated Resource Plan (IRP) Preferred Portfolio "PO2-MM-CETA", converted into annual values using load shapes from the same IRP.
- **Modeling Inputs:** measure savings, costs, non-energy impacts (NEIs), measure lives, incentive levels, program delivery, and portfolio costs were based on estimates provided by PacifiCorp.
- **Net-to-Gross (NTG):** ratios are assumed to be 1.0, consistent with condition (8)(a) to Order 01 in Docket UE-152072.
- **Retail Rates:** 2021 rates provided by PacifiCorp and escalated by inflation for future years.

Tables 1 and 2 below summarize cost-effectiveness assumptions for the PacifiCorp Washington Home Energy Savings program. All costs and impacts are presented at the program level. Table 3 provides the annual savings for the program.



Table 1: Cost-Effectiveness Analysis Inputs

Parameter	PY2021
Discount Rate	6.92%
Residential Line Loss	7.68%
Residential Energy Rate (\$/kWh)	\$0.0828
Inflation Rate	2.28%
Net-to-Gross	100%
Realization Rate	100%
Energy-to-Capacity Conversion Factor	0.000178976

Table 2: Annual Program Level Costs, Nominal - PY2021¹

Portfolio Level Expense	Program Delivery	Utility Admin	Program Development	Incentives	Total Utility Budget	Gross Customer Costs
Appliances	\$12,697	\$283	\$76	\$11,710	\$24,765	\$7,226
Building Shell	\$34,384	\$766	\$205	\$38,140	\$73,495	\$76,290
Energy Kits	\$55,504	\$66	\$18	\$188	\$55,775	\$0
HVAC	\$1,666,309	\$37,121	\$9,945	\$1,189,444	\$2,902,819	\$2,174,553
Lighting	\$310,079	\$10,551	\$2,827	\$251,365	\$574,821	\$108,081
Water Heating	\$20,930	\$466	\$125	\$11,500	\$33,021	\$31,495
Whole Home	\$51,330	\$1,143	\$306	\$56,850	\$109,630	\$17,807
Coupons	\$32,040	\$900	\$241	\$9,018	\$42,199	\$30,028
Total	\$2,183,272	\$51,296	\$13,743	\$1,568,214	\$3,816,526	\$2,445,480

Table 3: Annual Savings - PY2021

Measure Category	Gross kWh Savings at Site	Realization Rate	Adjusted Gross kWh Savings at Site	NTG Ratio	Net kWh Savings at Site	Measure Life
Appliances	16,307	100%	16,307	100%	16,307	14
Building Shell	44,161	83%	36,653	100%	36,653	45
Energy Kits	3,800	94%	3,572	100%	3,572	9
HVAC	2,140,126	94%	2,011,719	100%	2,011,719	17
Lighting	608,301	93%	564,560	100%	564,560	4
Water Heating	26,881	100%	26,881	100%	26,881	13
Whole Home	65,926	91%	59,820	100%	59,820	33
Coupons	51,890	94%	48,777	100%	48,777	6
Total	2,957,392	94%	2,768,289	100%	2,768,289	15

¹ To align with annual budget expectations, cost-effectiveness inputs are presented in nominal dollars.



Tables 4 through 13 present the cost-effectiveness results at the program and measure category levels. Tables 14 through 21 present the NEI impacts for the program and the cost-effectiveness results with NEIs at the program and measure category levels.

Table 4: 2021 Benefit/Cost Ratios by Measure Category

Program	PTRC	TRC	UCT	PCT	RIM
Appliances	0.92	0.83	0.68	3.61	0.43
Appliances (with NEIs)	1.56	1.48	0.68	5.43	0.43
Building Shell	0.84	0.76	1.16	1.29	0.64
Building Shell (with NEIs)	0.87	0.79	1.16	1.33	0.64
Energy Kits	0.06	0.05	0.05	0.00	0.05
Energy Kits (with NEIs)	0.06	0.05	0.05	0.00	0.05
HVAC	0.71	0.65	0.87	1.48	0.51
HVAC (with NEIs)	0.76	0.69	0.87	1.55	0.51
Lighting	0.77	0.70	0.53	4.31	0.38
Lighting (with NEIs)	1.11	1.04	0.53	5.65	0.38
Water Heating	0.52	0.47	0.76	1.08	0.45
Water Heating (with NEIs)	0.52	0.47	0.76	1.08	0.45
Whole Home	1.93	1.76	1.13	8.12	0.63
Whole Home (with NEIs)	1.95	1.77	1.13	8.19	0.63
Coupons	0.60	0.55	0.82	1.13	0.52
Coupons (with NEIs)	0.60	0.55	0.82	1.13	0.52
Total Program	0.73	0.66	0.82	1.65	0.50
Total Program (with NEIs)	0.80	0.73	0.82	1.78	0.50

Table 5: 2021 Home Energy Savings Program Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1699	\$4,693,791	\$3,429,079	-\$1,264,713	0.73
Total Resource Cost Test (TRC) No Adder	\$0.1699	\$4,693,791	\$3,117,344	-\$1,576,447	0.66
Utility Cost Test (UCT)	\$0.1381	\$3,816,526	\$3,117,344	-\$699,182	0.82
Participant Cost Test (PCT)		\$2,445,480	\$4,027,529	\$1,582,049	1.65
Rate Impact Test (RIM)		\$6,275,840	\$3,117,344	-\$3,158,496	0.50
Lifecycle Revenue Impacts (\$/kWh)					\$0.0001097
Discounted Participant Payback (years)					6.90



Table 6: 2021 Home Energy Savings Appliances Cost-Effectiveness Results (Load Shape - Residential_ERWH_7P)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1229	\$20,281	\$18,609	-\$1,672	0.92
Total Resource Cost Test (TRC) No Adder	\$0.1229	\$20,281	\$16,917	-\$3,364	0.83
Utility Cost Test (UCT)	\$0.1501	\$24,765	\$16,917	-\$7,848	0.68
Participant Cost Test (PCT)		\$7,226	\$26,105	\$18,879	3.61
Rate Impact Test (RIM)		\$39,160	\$16,917	-\$22,243	0.43
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000010
Discounted Participant Payback (years)					2.49

Table 7: 2021 Home Energy Savings Building Shell Cost-Effectiveness Results (Load Shape - WA_Single_Family_Heat_pump)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1926	\$111,645	\$93,741	-\$17,904	0.84
Total Resource Cost Test (TRC) No Adder	\$0.1926	\$111,645	\$85,219	-\$26,426	0.76
Utility Cost Test (UCT)	\$0.1268	\$73,495	\$85,219	\$11,724	1.16
Participant Cost Test (PCT)		\$76,290	\$98,576	\$22,286	1.29
Rate Impact Test (RIM)		\$133,931	\$85,219	-\$48,712	0.64
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000023
Discounted Participant Payback (years)					33.83

Table 8: 2021 Home Energy Savings Home Energy Kit Cost-Effectiveness Results (Load Shape - Residential_ERWH_7P)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$2.0676	\$55,587	\$3,069	-\$52,518	0.06
Total Resource Cost Test (TRC) No Adder	\$2.0676	\$55,587	\$2,790	-\$52,797	0.05
Utility Cost Test (UCT)	\$2.0746	\$55,775	\$2,790	-\$52,985	0.05
Participant Cost Test (PCT)		\$0	\$2,431	\$2,431	n/a
Rate Impact Test (RIM)		\$58,019	\$2,790	-\$55,228	0.05
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000020
Discounted Participant Payback (years)					0.00



Table 9: 2021 Home Energy Savings HVAC Cost-Effectiveness Results (Load Shape - WA_Single_Family_Heat_pump)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1710	\$3,887,929	\$2,779,440	-\$1,108,489	0.71
Total Resource Cost Test (TRC) No Adder	\$0.1710	\$3,887,929	\$2,526,763	-\$1,361,166	0.65
Utility Cost Test (UCT)	\$0.1277	\$2,902,819	\$2,526,763	-\$376,056	0.87
Participant Cost Test (PCT)		\$2,174,553	\$3,222,319	\$1,047,766	1.48
Rate Impact Test (RIM)		\$4,935,695	\$2,526,763	-\$2,408,931	0.51
Lifecycle Revenue Impacts (\$/kWh)					\$0.0001165
Discounted Participant Payback (years)					10.84

Table 10: 2021 Home Energy Savings Lighting Cost-Effectiveness Results (Load Shape - Residential_LIGHTING_7P)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1616	\$431,537	\$332,328	-\$99,209	0.77
Total Resource Cost Test (TRC) No Adder	\$0.1616	\$431,537	\$302,116	-\$129,421	0.70
Utility Cost Test (UCT)	\$0.2152	\$574,821	\$302,116	-\$272,705	0.53
Participant Cost Test (PCT)		\$108,081	\$465,668	\$357,587	4.31
Rate Impact Test (RIM)		\$789,125	\$302,116	-\$487,008	0.38
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000429
Discounted Participant Payback (years)					0.79

Table 11: 2021 Home Energy Savings Water Heating Cost-Effectiveness Results (Load Shape - Residential_HPWH_7P)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.2040	\$53,015	\$27,441	-\$25,574	0.52
Total Resource Cost Test (TRC) No Adder	\$0.2040	\$53,015	\$24,947	-\$28,069	0.47
Utility Cost Test (UCT)	\$0.1271	\$33,021	\$24,947	-\$8,074	0.76
Participant Cost Test (PCT)		\$31,495	\$33,979	\$2,484	1.08
Rate Impact Test (RIM)		\$55,500	\$24,947	-\$30,553	0.45
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000015
Discounted Participant Payback (years)					12.05



Table 12: 2021 Home Energy Savings Whole Home Cost-Effectiveness Results (Load Shape - WA_Single_Family_Heat_pump)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0797	\$70,588	\$136,390	\$65,803	1.93
Total Resource Cost Test (TRC) No Adder	\$0.0797	\$70,588	\$123,991	\$53,404	1.76
Utility Cost Test (UCT)	\$0.1238	\$109,630	\$123,991	\$14,361	1.13
Participant Cost Test (PCT)		\$17,807	\$144,587	\$126,780	8.12
Rate Impact Test (RIM)		\$197,367	\$123,991	-\$73,376	0.63
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000036
Discounted Participant Payback (years)					4.00

Table 13: 2021 Home Energy Savings Coupons Cost-Effectiveness Results (Load Shape - WA_Single_Family_Heat_pump)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.2083	\$63,209	\$38,061	-\$25,148	0.60
Total Resource Cost Test (TRC) No Adder	\$0.2083	\$63,209	\$34,601	-\$28,608	0.55
Utility Cost Test (UCT)	\$0.1390	\$42,199	\$34,601	-\$7,598	0.82
Participant Cost Test (PCT)		\$30,028	\$33,863	\$3,835	1.13
Rate Impact Test (RIM)		\$67,044	\$34,601	-\$32,443	0.52
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000028
Discounted Participant Payback (years)					5.74

Table 14: 2021 Home Energy Savings Non-Energy Impacts by Measure Category

Measure	Annual NEIs	Quantity	Measure Life	Total Present Value NEIs
Appliances	\$1,395	89	14	\$13,110
Building Shell	\$195	106,925	45	\$2,867
Energy Kits	\$19	25	9	\$133
HVAC	\$15,133	1,380	17	\$158,848
Lighting	\$32,980	169,766	4	\$144,894
Whole Home	\$87	22	33	\$1,202
Total	\$49,810	278,207	15	\$321,054



Table 15: 2021 Home Energy Savings Program Cost-Effectiveness Results (Including NEIs)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1699	\$4,693,791	\$3,750,132	-\$943,659	0.80
Total Resource Cost Test (TRC) No Adder	\$0.1699	\$4,693,791	\$3,438,398	-\$1,255,393	0.73
Utility Cost Test (UCT)	\$0.1381	\$3,816,526	\$3,117,344	-\$699,182	0.82
Participant Cost Test (PCT)		\$2,445,480	\$4,348,583	\$1,903,103	1.78
Rate Impact Test (RIM)		\$6,275,840	\$3,117,344	-\$3,158,496	0.50
Lifecycle Revenue Impacts (\$/kWh)					\$0.0001097
Discounted Participant Payback (years)					6.90

Table 16: 2021 Home Energy Savings Appliances Cost-Effectiveness Results (Including NEIs) (Load Shape - Residential_ERWH_7P)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1229	\$20,281	\$31,719	\$11,438	1.56
Total Resource Cost Test (TRC) No Adder	\$0.1229	\$20,281	\$30,027	\$9,746	1.48
Utility Cost Test (UCT)	\$0.1501	\$24,765	\$16,917	-\$7,848	0.68
Participant Cost Test (PCT)		\$7,226	\$39,215	\$31,989	5.43
Rate Impact Test (RIM)		\$39,160	\$16,917	-\$22,243	0.43
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000010
Discounted Participant Payback (years)					2.49

Table 17: 2021 Home Energy Savings Building Shell Cost-Effectiveness Results (Including NEIs) (Load Shape - WA_Single_Family_Heat_pump)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1926	\$111,645	\$96,608	-\$15,037	0.87
Total Resource Cost Test (TRC) No Adder	\$0.1926	\$111,645	\$88,086	-\$23,559	0.79
Utility Cost Test (UCT)	\$0.1268	\$73,495	\$85,219	\$11,724	1.16
Participant Cost Test (PCT)		\$76,290	\$101,443	\$25,153	1.33
Rate Impact Test (RIM)		\$133,931	\$85,219	-\$48,712	0.64
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000023
Discounted Participant Payback (years)					33.83



Table 18: 2021 Home Energy Savings Home Energy Kit Cost-Effectiveness Results (Including NEIs) (Load Shape - Residential_ERWH_7P)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$2.0676	\$55,587	\$3,202	-\$52,385	0.06
Total Resource Cost Test (TRC) No Adder	\$2.0676	\$55,587	\$2,923	-\$52,664	0.05
Utility Cost Test (UCT)	\$2.0746	\$55,775	\$2,790	-\$52,985	0.05
Participant Cost Test (PCT)		\$0	\$2,564	\$2,564	n/a
Rate Impact Test (RIM)		\$58,019	\$2,790	-\$55,228	0.05
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000020
Discounted Participant Payback (years)					0.00

Table 19: 2021 Home Energy Savings HVAC Cost-Effectiveness Results (Including NEIs) (Load Shape - WA_Single_Family_Heat_pump)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1710	\$3,887,929	\$2,938,288	-\$949,641	0.76
Total Resource Cost Test (TRC) No Adder	\$0.1710	\$3,887,929	\$2,685,611	-\$1,202,317	0.69
Utility Cost Test (UCT)	\$0.1277	\$2,902,819	\$2,526,763	-\$376,056	0.87
Participant Cost Test (PCT)		\$2,174,553	\$3,381,167	\$1,206,614	1.55
Rate Impact Test (RIM)		\$4,935,695	\$2,526,763	-\$2,408,931	0.51
Lifecycle Revenue Impacts (\$/kWh)					\$0.0001165
Discounted Participant Payback (years)					10.84

Table 20: 2021 Home Energy Savings Lighting Cost-Effectiveness Results (Including NEIs) (Load Shape - Residential_LIGHTING_7P)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.1616	\$431,537	\$477,222	\$45,684	1.11
Total Resource Cost Test (TRC) No Adder	\$0.1616	\$431,537	\$447,010	\$15,473	1.04
Utility Cost Test (UCT)	\$0.2152	\$574,821	\$302,116	-\$272,705	0.53
Participant Cost Test (PCT)		\$108,081	\$610,562	\$502,481	5.65
Rate Impact Test (RIM)		\$789,125	\$302,116	-\$487,008	0.38
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000429
Discounted Participant Payback (years)					0.79



Table 21: 2021 Home Energy Savings Whole Home Cost-Effectiveness Results (Including NEIs) (Load Shape - WA_Single_Family_Heat_pump)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0797	\$70,588	\$137,592	\$67,005	1.95
Total Resource Cost Test (TRC) No Adder	\$0.0797	\$70,588	\$125,193	\$54,606	1.77
Utility Cost Test (UCT)	\$0.1238	\$109,630	\$123,991	\$14,361	1.13
Participant Cost Test (PCT)		\$17,807	\$145,789	\$127,982	8.19
Rate Impact Test (RIM)		\$197,367	\$123,991	-\$73,376	0.63
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000036
Discounted Participant Payback (years)					4.00



MEMORANDUM

To: Alesha Pino, PacifiCorp
From: Andrew Cottrell, Andy Hudson, Dylan Royalty, AEG
Date: April 27, 2022
Re: PacifiCorp Washington Home Energy Reporting Program Cost-Effectiveness Results – PY2021

AEG estimated the cost-effectiveness of PacifiCorp's overall energy efficiency portfolio in the state of Washington based on Program Year (PY) 2021 costs and savings estimates provided by PacifiCorp. This memo provides cost-effectiveness results for the Home Energy Reporting program. The program passes the Total Resource Cost Test (TRC), the PacifiCorp Total Resource Cost Test (PTRC), and the Utility Cost Test (UCT).

This memo provides analysis inputs and results in the following tables:

Table 1: Cost-Effectiveness Analysis Inputs

Table 2: Annual Program Level Costs, Nominal - PY2021

Table 3: Annual Savings - PY2021

Table 4: 2021 Home Energy Reports Cost-Effectiveness Results (Load Shape - WA_Single_Family_Heat_pump)

The following assumptions were utilized in the analysis:

- **Avoided Costs:** derived from PacifiCorp's 2021 Integrated Resource Plan (IRP) Preferred Portfolio "P02-MM-CETA", converted into annual values using load shapes from the same IRP.
- **Modeling Inputs:** measure savings, costs, non-energy impacts (NEIs), measure lives, incentive levels, program delivery, and portfolio costs were based on estimates provided by PacifiCorp.
- **Net-to-Gross (NTG):** ratios are assumed to be 1.0, consistent with condition (8)(a) to Order 01 in Docket UE-152072.
- **Retail Rates:** 2021 rates provided by PacifiCorp and escalated by inflation for future years.



Tables 1 and 2 below summarize cost-effectiveness assumptions for the PacifiCorp Washington Home Energy Reporting program. All costs and impacts are presented at the program level. Tables 3 and 4 provide the annual savings and cost effectiveness for the program.

Table 1: Cost-Effectiveness Analysis Inputs

Parameter	PY2021
Discount Rate	6.92%
Residential Line Loss	7.68%
Residential Energy Rate (\$/kWh)	\$0.0828
Inflation Rate	2.28%
Measure Life	2
NTG	100%
Realization Rate	100%

Table 2: Annual Program Level Costs, Nominal - PY2021¹

Program Year	Program Delivery	Utility Admin	Engineering Costs	Program Development	Inspection Costs	Incentives	Total Utility Budget
2021	\$338,856	\$19,768	\$0	\$7,639	\$0	\$0	\$366,263
Total	\$338,856	\$19,768	\$0	\$7,639	\$0	\$0	\$366,263

Table 3: Annual Savings - PY2021

Program Year	Gross kWh Savings at Site	Realization Rate	Adjusted Gross kWh Savings at Site	NTG Ratio	Net kWh Savings at Site	Measure Life
2021	3,333,142	100%	3,333,142	100%	3,333,142	2
Total Program	3,333,142	100%	3,333,142	100%	3,333,142	2

¹ To align with annual budget expectations, cost-effectiveness inputs are presented in nominal dollars.



Table 4: 2021 Home Energy Reports Cost-Effectiveness Results (Load Shape - WA_Single_Family_Heat_pump)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0527	\$366,263	\$928,801	\$562,538	2.54
Total Resource Cost Test (TRC) No Adder	\$0.0527	\$366,263	\$844,365	\$478,102	2.31
Utility Cost Test (UCT)	\$0.0527	\$366,263	\$844,365	\$478,102	2.31
Participant Cost Test (PCT)		\$0	\$539,991	\$539,991	n/a
Rate Impact Test (RIM)		\$906,254	\$844,365	-\$61,890	0.93
Lifecycle Revenue Impacts (\$/kWh)					\$0.0001125
Discounted Participant Payback (years)					0.00



MEMORANDUM

To: Alesha Pino, PacifiCorp
From: Andrew Cottrell, Andy Hudson, Dylan Royalty, AEG
Date: April 27, 2022
Re: PacifiCorp Washington Low Income Weatherization Program Cost-Effectiveness Results – PY2021

AEG estimated the cost-effectiveness of PacifiCorp's overall energy efficiency portfolio in the state of Washington based on Program Year (PY) 2021 costs and savings estimates provided by PacifiCorp. This memo provides cost-effectiveness results for the Low Income Weatherization program.

This memo provides analysis inputs and results in the following tables:

Table 1: Cost-Effectiveness Analysis Inputs

Table 2: Annual Program Level Costs, Nominal - PY2021

Table 3: Annual Savings - PY2021

Table 4: 2021 Low Income Weatherization Program Cost-Effectiveness Results

Table 5: 2021 Low Income Weatherization Program Non-Energy Impacts

Table 6: 2021 Low Income Weatherization Program Cost-Effectiveness Results (Including NEIs)

The following assumptions were utilized in the analysis:

- **Avoided Costs:** derived from PacifiCorp's 2021 Integrated Resource Plan (IRP) Preferred Portfolio "P02-MM-CETA", converted into annual values using load shapes from the same IRP.
- **Modeling Inputs:** measure savings, costs, non-energy impacts (NEIs), measure lives, incentive levels, program delivery, and portfolio costs were based on estimates provided by PacifiCorp.
- **Net-to-Gross (NTG):** ratios are assumed to be 1.0, consistent with condition (8)(a) to Order 01 in Docket UE-152072.
- **Retail Rates:** 2021 rates provided by PacifiCorp and escalated by inflation for future years.



Tables 1 and 2 below summarize cost-effectiveness assumptions for the PacifiCorp Washington Low Income Weatherization program. All costs and impacts are presented at the program level. Table 3 provides the annual savings for the program.

Table 1: Cost-Effectiveness Analysis Inputs

Parameter	PY2021
Discount Rate	6.92%
Residential Line Loss	7.68%
Residential Energy Rate (\$/kWh)	\$0.0828
Inflation Rate ¹	2.28%
Net-to-Gross	100%
Realization Rate	59%

Table 2: Annual Program Level Costs, Nominal - PY2021¹

Program Year	Program Delivery	Utility Admin	Engineering Costs	Program Development	Inspection Costs	Incentives	Total Utility Budget
2021	\$69,523	\$7,780	\$0	\$332	\$3,236	\$426,783	\$507,654
Total	\$69,523	\$7,780	\$0	\$332	\$3,236	\$426,783	\$507,654

Table 3: Annual Savings - PY2021

Program Year	Gross kWh Savings at Site	Realization Rate	Adjusted Gross kWh Savings at Site	NTG Ratio	Net kWh Savings at Site	Measure Life
2021	116,769	59%	68,894	100%	68,894	23
Total Program	116,769	59%	68,894	100%	68,894	23

Table 4 below present the cost-effectiveness results at the program level. Tables 5 and 6 present the NEI impacts for the program and the cost-effectiveness results with NEIs at the program level.

¹ To align with annual budget expectations, cost-effectiveness inputs are presented in nominal dollars.



Table 4: 2021 Low Income Weatherization Program Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.5541	\$507,654	\$128,469	-\$379,185	0.25
Total Resource Cost Test (TRC) No Adder	\$0.5541	\$507,654	\$116,790	-\$390,864	0.23
Utility Cost Test (UCT)	\$0.5541	\$507,654	\$124,408	-\$383,246	0.25
Participant Cost Test (PCT)		\$0	\$512,908	\$512,908	n/a
Rate Impact Test (RIM)		\$593,778	\$124,408	-\$469,371	0.21
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000119
Discounted Participant Payback (years)					0.00

Table 5: 2021 Low Income Weatherization Program Non-Energy Impacts

Non-Energy Impact	Program Impact	Perspective Adjusted
Home Repair Costs paid by Company	\$14,269	PTRC, TRC
Economic Benefit	\$124,089	PTRC, TRC
Arrearage	\$7,618	PTRC, TRC, UCT, RIM
Payment Assistance	\$26,270	PTRC, TRC
Total	\$172,246	N/A

Table 6: 2021 Low Income Weatherization Program Cost-Effectiveness Results (Including NEIs)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.5541	\$507,654	\$300,715	-\$206,939	0.59
Total Resource Cost Test (TRC) No Adder	\$0.5541	\$507,654	\$289,036	-\$218,618	0.57
Utility Cost Test (UCT)	\$0.5541	\$507,654	124,408	-\$383,246	0.25
Participant Cost Test (PCT)		\$0	\$512,908	\$512,908	n/a
Rate Impact Test (RIM)		\$593,778	\$124,408	-\$469,371	0.21
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000119
Discounted Participant Payback (years)					0.00



MEMORANDUM

To: Alesha Pino, PacifiCorp
From: Andrew Cottrell, Andy Hudson, Dylan Royalty, AEG
Date: April 27, 2022
Re: PacifiCorp Washington Wattsmart Business Program Cost-Effectiveness Results – PY2021

AEG estimated the cost-effectiveness of PacifiCorp's overall energy efficiency portfolio in the state of Washington based on Program Year (PY) 2021 costs and savings¹ estimates provided by PacifiCorp. This memo provides cost-effectiveness results for the Wattsmart Business program. The program passes the following cost effectiveness tests: Total Resource Cost Test (TRC), the PacifiCorp Total Resource Cost Test (PTRC), the Utility Cost Test (UCT), and the Participant Cost Test (PCT).

This memo provides analysis inputs and results in the following tables:

Table 1: Cost-Effectiveness Analysis Inputs

Table 2: Annual Program Level Costs, Nominal - PY2021

Table 3: Annual Savings - PY2021

Table 4: Benefit/Cost Ratios by Measure Category

Table 5: 2021 Wattsmart Business Program Cost-Effectiveness Results

Table 6: 2021 Wattsmart Business Additional Measures Cost-Effectiveness Results (Load Shape - WA_Industrial_Machinery_General)

Table 7: 2021 Wattsmart Business Compressed Air Cost-Effectiveness Results (Load Shape - WA_Industrial_Machinery_General)

Table 8: 2021 Wattsmart Business Energy Management Cost-Effectiveness Results (Load Shape - WA_Miscellaneous_Mfg_General)

Table 9: 2021 Wattsmart Business Food Service Equipment Cost-Effectiveness Results (Load Shape - WA_School_Cooking)

¹ The commercial line loss factor was used for all Wattsmart Business savings; commercial sector savings represent approximately 74% of total program savings.



Table 10: 2021 Wattsmart Business HVAC Cost-Effectiveness Results (Load Shape - WA_Large_Retail_Space_Cool)

Table 11: 2021 Wattsmart Business Irrigation Cost-Effectiveness Results (Load Shape - WA_Irrigation_General)

Table 12: 2021 Wattsmart Business Lighting Cost-Effectiveness Results (Load Shape - WA_Miscellaneous_Lighting)

Table 13: 2021 Wattsmart Business Motors Cost-Effectiveness Results (Load Shape - WA_Industrial_Machinery_General)

Table 14: 2021 Wattsmart Business Refrigeration Cost-Effectiveness Results (Load Shape - WA_Warehouse_Refrigeration)

Table 15: 2021 Wattsmart Business Farm & Dairy Cost-Effectiveness Results (Load Shape - WA_Industrial_Machinery_General)

Table 16: 2021 Wattsmart Business Energy Project Mgr Co-Fund Cost-Effectiveness Results (Load Shape - WA_Miscellaneous_Mfg_General)

Table 17: 2021 Wattsmart Business Non-Energy Impacts by Measure Category

Table 18: 2021 Wattsmart Business Program Cost-Effectiveness Results (Including NEIs)

Table 19: 2021 Wattsmart Business Irrigation Cost-Effectiveness Results (Including NEIs) (Load Shape - WA_Irrigation_General)

The following assumptions were utilized in the analysis:

- **Avoided Costs:** derived from PacifiCorp's 2021 Integrated Resource Plan (IRP) Preferred Portfolio "PO2-MM-CETA", converted into annual values using load shapes from the same IRP.
- **Modeling Inputs:** measure savings, costs, non-energy impacts (NEIs), measure lives, incentive levels, program delivery, and portfolio costs were based on estimates provided by PacifiCorp.
- **Net-to-Gross (NTG):** ratios are assumed to be 1.0, consistent with condition (8)(a) to Order 01 in Docket UE-152072.
- **Retail Rates:** 2021 rates provided by PacifiCorp and escalated by inflation for future years.

Tables 1 and 2 below summarize cost-effectiveness assumptions for the PacifiCorp Washington Wattsmart Business program. All costs and impacts are presented at the program level. Table 3 provides the annual savings for the program.



Table 1: Cost-Effectiveness Analysis Inputs

Parameter	PY2021
Discount Rate	6.92%
Commercial Line Loss	7.60%
Industrial Line Loss	6.82%
Irrigation Line Loss	7.68%
Commercial Energy Rate (\$/kWh)	\$0.0809
Industrial Energy Rate (\$/kWh)	\$0.0666
Irrigation Energy Rate (\$/kWh)	\$0.0890
Inflation Rate	2.28%

Table 2: Annual Program Level Costs, Nominal - PY2021²

Measure Category	Program Delivery	Utility Admin	Program Development	Incentives
Additional Measures	\$51,366	\$13,994	\$3,689	\$92,865
Compressed Air	\$149,302	\$9,135	\$6,525	\$122,240
Energy Management	\$271,057	\$41,130	\$12,368	\$46,463
Food Service Equipment	\$10,772	\$2,533	\$643	\$7,460
HVAC	\$56,330	\$10,478	\$2,658	\$63,827
Irrigation	\$192,043	\$9,426	\$3,732	\$97,826
Lighting	\$1,414,010	\$208,837	\$71,697	\$1,873,466
Motors	\$72,189	\$10,246	\$3,609	\$84,653
Refrigeration	\$411,891	\$56,849	\$14,917	\$275,988
Farm & Dairy	\$17,819	\$1,193	\$303	\$8,367
Energy Project Mgr Co-fund	\$0	\$0	\$0	\$46,175
Total	\$2,646,778	\$363,820	\$120,139	\$2,719,330

² To align with annual budget expectations, cost-effectiveness inputs are presented in nominal dollars.



Table 3: Annual Savings - PY2021

Measure Category	Gross kWh Savings at Site	Realization Rate	Adjusted Gross kWh Savings at Site	NTG Ratio	Net kWh Savings at Site	Measure Life
Additional Measures	566,747	95%	537,782	100%	537,782	15
Compressed Air	1,002,536	95%	950,404	100%	950,404	14
Energy Management	1,900,169	100%	1,898,086	100%	1,898,086	3
Food Service Equipment	98,740	99%	98,207	100%	98,207	13
HVAC	408,422	100%	408,422	100%	408,422	14
Irrigation	573,413	90%	514,925	100%	514,925	11
Lighting	11,015,522	100%	11,060,312	100%	11,060,312	11
Motors	554,444	99%	549,454	100%	549,454	15
Refrigeration	2,291,797	100%	2,291,797	100%	2,291,797	15
Farm & Dairy	46,486	100%	46,486	100%	46,486	15
Energy Project Mgr Co-fund	0	0%	0	0%	0	0
Total	18,458,276	99%	18,355,875	100%	18,355,875	11

Tables 4 through 16 present the cost-effectiveness results at the program and measure category levels. Tables 17 through 19 present the NEI impacts for the program and the cost-effectiveness results with NEIs at the program and measure category levels.

Table 4: 2021 Benefit/Cost Ratios by Measure Category

Program	PTRC	TRC	UCT	PCT	RIM
Additional Measures	2.14	1.95	3.66	2.47	0.91
Compressed Air	3.20	2.91	3.65	5.05	0.91
Energy Management	1.93	1.75	1.78	9.40	0.81
Food Service Equipment	3.21	2.92	3.41	7.92	0.72
HVAC	2.14	1.94	4.72	1.64	1.30
Irrigation	1.56	1.42	2.05	2.12	0.89
Lighting	2.54	2.31	2.70	3.98	0.83
Motors	2.97	2.70	3.55	4.21	0.91
Refrigeration	3.29	2.99	3.63	5.60	0.94
Farm & Dairy	1.61	1.46	1.85	3.22	0.73
Energy Project Mgr Co-fund	0.00	0.00	0.00	0.00	0.00
Total Program	2.55	2.32	2.85	3.96	0.87
Total Program (with NEIs)	2.56	2.32	2.85	3.97	0.87



Table 5: 2021 Wattsmart Business Program Cost-Effectiveness Results

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0453	\$7,172,675	\$18,317,211	\$11,144,536	2.55
Total Resource Cost Test (TRC) No Adder	\$0.0453	\$7,172,675	\$16,652,010	\$9,479,335	2.32
Utility Cost Test (UCT)	\$0.0369	\$5,850,068	\$16,652,010	\$10,801,942	2.85
Participant Cost Test (PCT)		\$4,041,937	\$16,010,995	\$11,969,058	3.96
Rate Impact Test (RIM)		\$19,141,733	\$16,652,010	-\$2,489,723	0.87
Lifecycle Revenue Impacts (\$/kWh)					\$0.0004668
Discounted Participant Payback (years)					2.67

Table 6: 2021 Wattsmart Business Additional Measures Cost-Effectiveness Results (Load Shape - WA_Industrial_Machinery_General)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0536	\$303,790	\$651,606	\$347,816	2.14
Total Resource Cost Test (TRC) No Adder	\$0.0536	\$303,790	\$592,369	\$288,579	1.95
Utility Cost Test (UCT)	\$0.0286	\$161,913	\$592,369	\$430,456	3.66
Participant Cost Test (PCT)		\$234,742	\$580,078	\$345,335	2.47
Rate Impact Test (RIM)		\$649,125	\$592,369	-\$56,756	0.91
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000164
Discounted Participant Payback (years)					6.07

Table 7: 2021 Wattsmart Business Compressed Air Cost-Effectiveness Results (Load Shape - WA_Industrial_Machinery_General)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0359	\$359,647	\$1,151,561	\$791,914	3.20
Total Resource Cost Test (TRC) No Adder	\$0.0359	\$359,647	\$1,046,874	\$687,227	2.91
Utility Cost Test (UCT)	\$0.0287	\$287,201	\$1,046,874	\$759,672	3.65
Participant Cost Test (PCT)		\$194,685	\$983,273	\$788,588	5.05
Rate Impact Test (RIM)		\$1,148,235	\$1,046,874	-\$101,361	0.91
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000290
Discounted Participant Payback (years)					2.86



Table 8: 2021 Wattsmart Business Energy Management Cost-Effectiveness Results (Load Shape - WA_Miscellaneous_Mfg_General)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0656	\$376,386	\$724,602	\$348,217	1.93
Total Resource Cost Test (TRC) No Adder	\$0.0656	\$376,386	\$658,729	\$282,344	1.75
Utility Cost Test (UCT)	\$0.0646	\$371,017	\$658,729	\$287,713	1.78
Participant Cost Test (PCT)		\$51,832	\$487,426	\$435,594	9.40
Rate Impact Test (RIM)		\$811,980	\$658,729	-\$153,251	0.81
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000693
Discounted Participant Payback (years)					0.32

Table 9: 2021 Wattsmart Business Food Service Equipment Cost-Effectiveness Results (Load Shape - WA_School_Cooking)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0264	\$25,019	\$80,272	\$55,253	3.21
Total Resource Cost Test (TRC) No Adder	\$0.0264	\$25,019	\$72,974	\$47,955	2.92
Utility Cost Test (UCT)	\$0.0226	\$21,408	\$72,974	\$51,566	3.41
Participant Cost Test (PCT)		\$11,071	\$87,700	\$76,629	7.92
Rate Impact Test (RIM)		\$101,648	\$72,974	-\$28,674	0.72
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000028
Discounted Participant Payback (years)					1.61

Table 10: 2021 Wattsmart Business HVAC Cost-Effectiveness Results (Load Shape - WA_Large_Retail_Space_Cool)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0784	\$323,673	\$691,873	\$368,200	2.14
Total Resource Cost Test (TRC) No Adder	\$0.0784	\$323,673	\$628,975	\$305,303	1.94
Utility Cost Test (UCT)	\$0.0323	\$133,293	\$628,975	\$495,682	4.72
Participant Cost Test (PCT)		\$254,207	\$416,089	\$161,883	1.64
Rate Impact Test (RIM)		\$485,555	\$628,975	\$143,420	1.30
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000128
Discounted Participant Payback (years)					8.50



Table 11: 2021 Wattsmart Business Irrigation Cost-Effectiveness Results (Load Shape - WA_Irrigation_General)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0928	\$438,680	\$683,707	\$245,027	1.56
Total Resource Cost Test (TRC) No Adder	\$0.0928	\$438,680	\$621,552	\$182,872	1.42
Utility Cost Test (UCT)	\$0.0641	\$303,027	\$621,552	\$318,525	2.05
Participant Cost Test (PCT)		\$233,479	\$494,085	\$260,607	2.12
Rate Impact Test (RIM)		\$699,287	\$621,552	-\$77,735	0.89
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000202
Discounted Participant Payback (years)					4.98

Table 12: 2021 Wattsmart Business Lighting Cost-Effectiveness Results (Load Shape - WA_Miscellaneous_Lighting)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0435	\$4,165,169	\$10,580,953	\$6,415,784	2.54
Total Resource Cost Test (TRC) No Adder	\$0.0435	\$4,165,169	\$9,619,048	\$5,453,879	2.31
Utility Cost Test (UCT)	\$0.0372	\$3,568,010	\$9,619,048	\$6,051,038	2.70
Participant Cost Test (PCT)		\$2,470,625	\$9,835,669	\$7,365,044	3.98
Rate Impact Test (RIM)		\$11,530,213	\$9,619,048	-\$1,911,165	0.83
Lifecycle Revenue Impacts (\$/kWh)					\$0.0003523
Discounted Participant Payback (years)					2.73

Table 13: 2021 Wattsmart Business Motors Cost-Effectiveness Results (Load Shape - WA_Industrial_Machinery_General)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0388	\$224,482	\$665,748	\$441,266	2.97
Total Resource Cost Test (TRC) No Adder	\$0.0388	\$224,482	\$605,225	\$380,744	2.70
Utility Cost Test (UCT)	\$0.0295	\$170,696	\$605,225	\$434,529	3.55
Participant Cost Test (PCT)		\$138,438	\$582,439	\$444,001	4.21
Rate Impact Test (RIM)		\$668,482	\$605,225	-\$63,257	0.91
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000169
Discounted Participant Payback (years)					3.46



Table 14: 2021 Wattsmart Business Refrigeration Cost-Effectiveness Results (Load Shape - WA_Warehouse_Refrigeration)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0368	\$920,819	\$3,030,564	\$2,109,746	3.29
Total Resource Cost Test (TRC) No Adder	\$0.0368	\$920,819	\$2,755,059	\$1,834,240	2.99
Utility Cost Test (UCT)	\$0.0303	\$759,645	\$2,755,059	\$1,995,414	3.63
Participant Cost Test (PCT)		\$437,162	\$2,447,578	\$2,010,417	5.60
Rate Impact Test (RIM)		\$2,931,235	\$2,755,059	-\$176,177	0.94
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000715
Discounted Participant Payback (years)					2.69

Table 15: 2021 Wattsmart Business Farm & Dairy Cost-Effectiveness Results (Load Shape - WA_Industrial_Machinery_General)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0715	\$35,012	\$56,325	\$21,313	1.61
Total Resource Cost Test (TRC) No Adder	\$0.0715	\$35,012	\$51,204	\$16,193	1.46
Utility Cost Test (UCT)	\$0.0565	\$27,682	\$51,204	\$23,523	1.85
Participant Cost Test (PCT)		\$15,697	\$50,482	\$34,785	3.22
Rate Impact Test (RIM)		\$69,797	\$51,204	-\$18,592	0.73
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000018
Discounted Participant Payback (years)					4.66

Table 16: 2021 Wattsmart Business Energy Project Mgr Co-Fund Cost-Effectiveness Results (Load Shape - WA_Miscellaneous_Mfg_General)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0000	\$0	\$0	\$0	n/a
Total Resource Cost Test (TRC) No Adder	\$0.0000	\$0	\$0	\$0	n/a
Utility Cost Test (UCT)	\$0.0000	\$46,175	\$0	-\$46,175	0.00
Participant Cost Test (PCT)		\$0	\$46,175	\$46,175	n/a
Rate Impact Test (RIM)		\$46,175	\$0	-\$46,175	0.00
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000000
Discounted Participant Payback (years)					0.00



Table 17: 2021 Wattsmart Business Non-Energy Impacts by Measure Category

Measure	Annual NEIs	Quantity	Measure Life	Total Present Value NEIs
Irrigation	\$2,631	1,919	11	\$22,439
Total	\$2,631	1,919	11	\$22,439

Table 18: 2021 Wattsmart Business Program Cost-Effectiveness Results (Including NEIs)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0453	\$7,172,675	\$18,339,649	\$11,166,974	2.56
Total Resource Cost Test (TRC) No Adder	\$0.0453	\$7,172,675	\$16,674,448	\$9,501,773	2.32
Utility Cost Test (UCT)	\$0.0369	\$5,850,068	\$16,652,010	\$10,801,942	2.85
Participant Cost Test (PCT)		\$4,041,937	\$16,033,433	\$11,991,496	3.97
Rate Impact Test (RIM)		\$19,141,733	\$16,652,010	-\$2,489,723	0.87
Lifecycle Revenue Impacts (\$/kWh)					\$0.0004668
Discounted Participant Payback (years)					2.67

Table 19: 2021 Wattsmart Business Irrigation Cost-Effectiveness Results (Including NEIs) (Load Shape - WA_Irrigation_General)

Cost-Effectiveness Test	Levelized \$/kWh	NPV Costs	NPV Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conservation Adder	\$0.0928	\$438,680	\$706,146	\$267,465	1.61
Total Resource Cost Test (TRC) No Adder	\$0.0928	\$438,680	\$643,990	\$205,310	1.47
Utility Cost Test (UCT)	\$0.0641	\$303,027	\$621,552	\$318,525	2.05
Participant Cost Test (PCT)		\$233,479	\$516,524	\$283,045	2.21
Rate Impact Test (RIM)		\$699,287	\$621,552	-\$77,735	0.89
Lifecycle Revenue Impacts (\$/kWh)					\$0.0000202
Discounted Participant Payback (years)					4.98