

Memorandum

To: Don Jones Jr., PacifiCorp/Rocky Mountain Power
From: David Basak, Navigant
Date: March 24, 2015
Re: Program Design Cost Effectiveness for the Utah New Homes Program

Navigant has developed this memo in response to PacifiCorp’s proposed New Homes Program cost effectiveness modeling needs in the state of Utah.

This memo presents the cost effectiveness results of individual analysis runs and a compilation of combined years for the state of Utah. Each scenario is analyzed using a high (+10%), expected, and low (-10%) participation with modeled assumptions provided by PacifiCorp. These scenarios utilize the following assumptions:

- **Avoided Costs:** Navigant utilized the “East” decrement value stream provided in the 2013 PacifiCorp Integrated Resource Plan. PacifiCorp identified measure types (i.e., cooling, lighting, and whole house) which were used to determine the appropriate decrement stream and load shape when calculating avoided costs. The measures types are as follows:
 - › Cooling Measures – East Cooling Decrement with the Residential Cooling load shape
 - › Lighting Measures – East Lighting Decrement with the Residential Lighting load shape
 - › Whole House Measures – East Whole House Decrement with the Residential Whole House load shape
- **Modeling Inputs:** Navigant utilized individual measure savings and administration costs provided by PacifiCorp in the file *Utah New Homes TRL CE Forecast 2015-2016 12 22 15+DLJ 012715.xlsx*.
- **Energy Rates:** Navigant utilized the 2013 rates provided by PacifiCorp and applied an escalation of 1.9% to arrive at estimated rates for PY2015 and PY2016.
- **Participation Variations:** Navigant provides three levels of participation; high (+10%), expected, and low (-10%).

This memo will begin by addressing the inputs for PY2015-2016 for the Utah New Homes Program. The cost-effectiveness inputs are as follows:

Table 1 –Cost Effectiveness Analysis Inputs

Parameters	2015	2016
Discount Rate for all B/C Tests	6.88%	6.88%
Line Loss Factor - Energy (%)	9.32%	9.32%
Residential Energy Rate (\$/kWh)	\$0.110	\$0.112
Net-to-Gross Ratio	80%	80%
Escalation Rate	1.9%	1.9%

Table 2 –Annual Program Costs for PY 2015-2016 (Source: PacifiCorp)

Scenario	Program Admin (\$)	Utility Admin (\$)	Evaluation (\$)
Program Year 2015	\$865,000	\$32,000	\$100,000
Program Year 2016	\$915,000	\$32,000	\$0
Total PY 2015-2016	\$1,780,000	\$64,000	\$100,000

Table 3 –Annual Program Incentives for PY 2015-2016 (Source: PacifiCorp)

Scenario	High Participation (+10%)	Expected Participation	Low Participation (-10%)
	Incentives (\$)	Incentives (\$)	Incentives (\$)
Program Year 2015	\$705,227	\$641,115	\$577,004
Program Year 2016	\$832,249	\$756,590	\$680,931
Total PY 2015-2016	\$1,537,476	\$1,397,705	\$1,257,935

Table 4 –Annual Program Savings at Site for PY 2015-2016 in kWh (Source: PacifiCorp)

Scenario	High Participation (+10%)		Expected Participation		Low Participation (-10%)	
	Gross Annual Energy Savings at Site (kWh)	Net Annual Energy Savings at Site (kWh)	Gross Annual Energy Savings at Site (kWh)	Net Annual Energy Savings at Site (kWh)	Gross Annual Energy Savings at Site (kWh)	Net Annual Energy Savings at Site (kWh)
Program Year 2015	2,919,070	2,335,256	2,653,700	2,122,960	2,388,330	1,910,664
Program Year 2016	3,480,741	2,784,593	3,164,310	2,531,448	2,847,879	2,278,303
Total PY 2015-2016	6,399,811	5,119,849	5,818,010	4,654,408	5,236,209	4,188,967

The total PY 2015 cost/benefits results for ALL sensitivities are as follows:

Table 5 – Total PY 2015 Cost/Benefit Test Results – High (+10% Participation)

Benefit/Cost Test Performed	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conversation Adder	\$0.1718	\$3,276,981	\$2,877,921	(\$399,060)	0.88
Total Resource Cost Test (TRC) No Adder	\$0.1718	\$3,276,981	\$2,616,292	(\$660,689)	0.80
Utility Cost Test (UCT)	\$0.0893	\$1,702,227	\$2,616,292	\$914,066	1.54
Rate Impact Test (RIM)		\$3,952,358	\$2,616,292	(\$1,336,066)	0.66
Participant Cost Test (PCT)		\$2,849,977	\$3,517,891	\$667,914	1.23
Lifecycle Revenue Impacts (\$/kWh)				\$0.000003647	
Discounted Participant Payback (years)				n/a	

Table 6 – Total PY 2015 Cost/Benefit Test Results – Expected Participation

Benefit/Cost Test Performed	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conversation Adder	\$0.1771	\$3,069,710	\$2,616,292	(\$453,418)	0.85
Total Resource Cost Test (TRC) No Adder	\$0.1771	\$3,069,710	\$2,378,448	(\$691,263)	0.77
Utility Cost Test (UCT)	\$0.0945	\$1,638,115	\$2,378,448	\$740,333	1.45
Rate Impact Test (RIM)		\$3,683,689	\$2,378,448	(\$1,305,242)	0.65
Participant Cost Test (PCT)		\$2,590,888	\$3,198,083	\$607,195	1.23
Lifecycle Revenue Impacts (\$/kWh)				\$0.000003563	
Discounted Participant Payback (years)				n/a	

Table 7 – Total PY 2015 Cost/Benefit Test Results – Low (-10% Participation)

Benefit/Cost Test Performed	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conversation Adder	\$0.1835	\$2,862,439	\$2,354,663	(\$507,776)	0.82
Total Resource Cost Test (TRC) No Adder	\$0.1835	\$2,862,439	\$2,140,603	(\$721,837)	0.75
Utility Cost Test (UCT)	\$0.1009	\$1,574,004	\$2,140,603	\$566,599	1.36
Rate Impact Test (RIM)		\$3,415,020	\$2,140,603	(\$1,274,418)	0.63
Participant Cost Test (PCT)		\$2,331,799	\$2,878,275	\$546,475	1.23
Lifecycle Revenue Impacts (\$/kWh)				\$0.000003478	
Discounted Participant Payback (years)				n/a	

The total PY 2016 cost/benefits results for ALL sensitivities are as follows:

Table 8 – Total PY 2016 Cost/Benefit Test Results – High (+10% Participation)

Benefit/Cost Test Performed	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conversation Adder	\$0.1622	\$3,673,123	\$3,433,329	(\$239,793)	0.93
Total Resource Cost Test (TRC) No Adder	\$0.1622	\$3,673,123	\$3,121,209	(\$551,914)	0.85
Utility Cost Test (UCT)	\$0.0786	\$1,779,249	\$3,121,209	\$1,341,960	1.75
Rate Impact Test (RIM)		\$4,502,214	\$3,121,209	(\$1,381,005)	0.69
Participant Cost Test (PCT)		\$3,407,654	\$4,235,955	\$828,301	1.24
Lifecycle Revenue Impacts (\$/kWh)				\$0.000003696	
Discounted Participant Payback (years)				n/a	

Table 9 – Total PY 2016 Cost/Benefit Test Results – Expected Participation

Benefit/Cost Test Performed	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conversation Adder	\$0.1664	\$3,425,294	\$3,121,209	(\$304,085)	0.91
Total Resource Cost Test (TRC) No Adder	\$0.1664	\$3,425,294	\$2,837,462	(\$587,831)	0.83
Utility Cost Test (UCT)	\$0.0827	\$1,703,590	\$2,837,462	\$1,133,872	1.67
Rate Impact Test (RIM)		\$4,179,012	\$2,837,462	(\$1,341,550)	0.68
Participant Cost Test (PCT)		\$3,097,867	\$3,850,868	\$753,001	1.24
Lifecycle Revenue Impacts (\$/kWh)				\$0.000003591	
Discounted Participant Payback (years)				n/a	

Table 10 – Total PY 2016 Cost/Benefit Test Results – Low (-10% Participation)

Benefit/Cost Test Performed	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conversation Adder	\$0.1715	\$3,177,464	\$2,809,088	(\$368,376)	0.88
Total Resource Cost Test (TRC) No Adder	\$0.1715	\$3,177,464	\$2,553,716	(\$623,748)	0.80
Utility Cost Test (UCT)	\$0.0879	\$1,627,931	\$2,553,716	\$925,785	1.57
Rate Impact Test (RIM)		\$3,855,811	\$2,553,716	(\$1,302,095)	0.66
Participant Cost Test (PCT)		\$2,788,080	\$3,465,781	\$677,701	1.24
Lifecycle Revenue Impacts (\$/kWh)				\$0.000003485	
Discounted Participant Payback (years)				n/a	

The total PY 2015-2016 cost/benefits results for ALL sensitivities are as follows:

Table 11 – Total PY 2015-2016 Cost/Benefit Test Results – High (+10% Participation)

Benefit/Cost Test Performed	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conversation Adder	\$0.1666	\$6,950,104	\$6,311,251	(\$638,853)	0.91
Total Resource Cost Test (TRC) No Adder	\$0.1666	\$6,950,104	\$5,737,501	(\$1,212,604)	0.83
Utility Cost Test (UCT)	\$0.0835	\$3,481,476	\$5,737,501	\$2,256,025	1.65
Rate Impact Test (RIM)		\$8,454,572	\$5,737,501	(\$2,717,071)	0.68
Participant Cost Test (PCT)		\$6,257,631	\$7,753,846	\$1,496,216	1.24
Lifecycle Revenue Impacts (\$/kWh)				\$0.000003672	
Discounted Participant Payback (years)				n/a	

Table 12 – Total PY 2015-2016 Cost/Benefit Test Results – Expected Participation

Benefit/Cost Test Performed	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conversation Adder	\$0.1713	\$6,495,004	\$5,737,501	(\$757,503)	0.88
Total Resource Cost Test (TRC) No Adder	\$0.1713	\$6,495,004	\$5,215,910	(\$1,279,094)	0.80
Utility Cost Test (UCT)	\$0.0881	\$3,341,705	\$5,215,910	\$1,874,205	1.56
Rate Impact Test (RIM)		\$7,862,702	\$5,215,910	(\$2,646,792)	0.66
Participant Cost Test (PCT)		\$5,688,755	\$7,048,951	\$1,360,196	1.24
Lifecycle Revenue Impacts (\$/kWh)				\$0.000003577	
Discounted Participant Payback (years)				n/a	

Table 13 – Total PY 2015-2016 Cost/Benefit Test Results – Low (-10% Participation)

Benefit/Cost Test Performed	Levelized \$/kWh	Costs	Benefits	Net Benefits	Benefit/Cost Ratio
Total Resource Cost Test (PTRC) + Conversation Adder	\$0.1770	\$6,039,904	\$5,163,751	(\$876,153)	0.85
Total Resource Cost Test (TRC) No Adder	\$0.1770	\$6,039,904	\$4,694,319	(\$1,345,585)	0.78
Utility Cost Test (UCT)	\$0.0938	\$3,201,935	\$4,694,319	\$1,492,384	1.47
Rate Impact Test (RIM)		\$7,270,832	\$4,694,319	(\$2,576,513)	0.65
Participant Cost Test (PCT)		\$5,119,880	\$6,344,056	\$1,224,176	1.24
Lifecycle Revenue Impacts (\$/kWh)				\$0.000003482	
Discounted Participant Payback (years)				n/a	

The measure level cost/benefits results are as follows:

Table 14 – Single Family Cost/Benefit Test Results – ALL Sensitivities

Utah New Homes Program Measure Level	Status	P-TRC Benefits (\$)	P-TRC Costs (\$)	P-TRC Test	TRC Benefits (\$)	TRC Costs (\$)	TRC Test	Utility PV Benefits (\$)	Utility PV Costs (\$)	Utility Cost Test	Ratepayer PV Benefits (\$)	Ratepayer PV Costs (\$)	RIM Test	Part. PV Benefits (\$)	Part. PV Cost (\$)	Part. Cost Test
ENERGY STAR v3 - whole home: Single Family - UT	Current	\$1,417	\$1,269	1.1	\$1,288	\$1,269	1.0	\$1,288	\$250	5.2	\$1,288	\$990	1.3	\$1,175	\$1,586	0.7
High Performance ENERGY STAR v3 - whole home: Single Family - UT	Current	\$2,803	\$2,548	1.1	\$2,548	\$2,548	1.0	\$2,548	\$500	5.1	\$2,548	\$1,964	1.3	\$2,330	\$3,185	0.7
Above Code Home - IECC 2009 Builder certified - whole home: Single Family - UT	Current	\$92	\$69	1.3	\$84	\$69	1.2	\$84	\$25	3.4	\$84	\$73	1.1	\$85	\$86	1.0
Above Code Home - IECC 2009 Rater certified - whole home: Single Family - UT	Current	\$106	\$52	2.0	\$97	\$52	1.9	\$97	\$25	3.9	\$97	\$80	1.2	\$94	\$65	1.5
HVAC-QI Contractor cert - standalone: Single Family - UT	Current	\$174	\$120	1.4	\$158	\$120	1.3	\$158	\$50	3.2	\$158	\$142	1.1	\$165	\$150	1.1
HVAC-QI Contractor cert w ECM - standalone: Single Family - UT	Retiring	\$770	\$476	1.6	\$700	\$476	1.5	\$700	\$200	3.5	\$700	\$609	1.2	\$711	\$595	1.2
HVAC-QI Rater cert - standalone: Single Family - UT	Current	\$347	\$255	1.4	\$316	\$255	1.2	\$316	\$100	3.2	\$316	\$284	1.1	\$330	\$319	1.0
HVAC-QI Rater cert w ECM - standalone: Single Family - UT	Retiring	\$944	\$835	1.1	\$858	\$835	1.0	\$858	\$250	3.4	\$858	\$751	1.1	\$876	\$1,044	0.8
95% AFUE Gas furnace with ECM: Single Family - UT	New	\$292	\$320	0.9	\$266	\$320	0.8	\$266	\$150	1.8	\$266	\$495	0.5	\$581	\$400	1.5
Exterior Wall Upgrade - standalone: Single Family - UT	Current	\$271	\$89	3.1	\$246	\$89	2.8	\$246	\$50	4.9	\$246	\$192	1.3	\$227	\$111	2.0
R-5 Windows - standalone: Single Family - UT	Current	\$210	\$602	0.3	\$191	\$602	0.3	\$191	\$40	4.8	\$191	\$149	1.3	\$177	\$752	0.2
80% ENERGY STAR lighting < 2000 sf: Single Family - UT	Current	\$158	\$32	4.9	\$144	\$32	4.5	\$144	\$40	3.6	\$144	\$259	0.6	\$314	\$40	7.9
80% ENERGY STAR lighting 2000 to 3500 sf: Single Family - UT	Current	\$229	\$54	4.3	\$208	\$54	3.9	\$208	\$60	3.5	\$208	\$378	0.6	\$457	\$67	6.8
80% ENERGY STAR lighting > 3500 sf: Single Family - UT	Current	\$230	\$71	3.2	\$209	\$71	2.9	\$209	\$80	2.6	\$209	\$399	0.5	\$479	\$89	5.4
60% ENERGY STAR lighting < 2000 sf: Single Family - UT	New	\$113	\$22	5.0	\$103	\$22	4.6	\$103	\$25	4.1	\$103	\$182	0.6	\$221	\$28	7.9
60% ENERGY STAR lighting 2000 to 3500 sf: Single Family - UT	New	\$164	\$38	4.3	\$149	\$38	3.9	\$149	\$45	3.3	\$149	\$272	0.5	\$329	\$48	6.8
60% ENERGY STAR lighting > 3500 sf: Single Family - UT	New	\$164	\$51	3.2	\$150	\$51	2.9	\$150	\$65	2.3	\$150	\$293	0.5	\$350	\$64	5.5
High efficiency air conditioning = 15 SEER: Single Family - UT	Current	\$390	\$366	1.1	\$354	\$366	1.0	\$354	\$100	3.5	\$354	\$307	1.2	\$359	\$458	0.8
Air-Source Heat Pump - 15 SEER+ (Cooling Only)	New	\$390	\$134	2.9	\$354	\$134	2.7	\$354	\$100	3.5	\$354	\$307	1.2	\$359	\$167	2.1
Air-Source Heat Pump - 15 SEER+ (Cooling/Heating)	New	\$654	\$496	1.3	\$595	\$496	1.2	\$595	\$250	2.4	\$595	\$1,028	0.6	\$1,222	\$620	2.0
Geothermal Heat Pump - standalone: Single Family - UT	Current	\$2,908	\$16,000	0.2	\$2,644	\$16,000	0.2	\$2,644	\$1,750	1.5	\$2,644	\$5,207	0.5	\$6,072	\$20,000	0.3
Premium Evaporative Equipment: Single Family - UT	Current	\$1,687	\$462	3.6	\$1,533	\$462	3.3	\$1,533	\$500	3.1	\$1,533	\$1,395	1.1	\$1,619	\$578	2.8
Premium Evaporative Ducted Equipment: Single Family - UT	Current	\$1,860	\$824	2.3	\$1,691	\$824	2.1	\$1,691	\$750	2.3	\$1,691	\$1,737	1.0	\$1,984	\$1,030	1.9
Qualified efficient refrigerator- CEE Tier 3: Single Family - UT	Current	\$82	\$104	0.8	\$74	\$104	0.7	\$74	\$20	3.7	\$74	\$116	0.6	\$139	\$130	1.1
Qualified efficient dishwasher- CEE Tier 1: Single Family - UT	Retiring	\$32	\$65	0.5	\$29	\$65	0.4	\$29	\$10	2.9	\$29	\$48	0.6	\$58	\$81	0.7

Table 15 – Multi-Family Cost/Benefit Test Results – ALL Sensitivities

Utah New Homes Program Measure Level	Status	P-TRC Benefits (\$)	P-TRC Costs (\$)	P-TRC Test	TRC Benefits (\$)	TRC Costs (\$)	TRC Test	Utility PV Benefits (\$)	Utility PV Costs (\$)	Utility Cost Test	Ratepayer PV Benefits (\$)	Ratepayer PV Costs (\$)	RIM Test	Part. PV Benefits (\$)	Part. PV Cost (\$)	Part. Cost Test
ENERGY STAR v3- standalone: Multifamily - UT	Current	\$844	\$783	1.1	\$767	\$783	1.0	\$767	\$150	5.1	\$767	\$591	1.3	\$701	\$979	0.7
High Performance ENERGY STAR v3 Home- standalone: Multifamily - UT	Current	\$1,135	\$1,886	0.6	\$1,031	\$1,886	0.5	\$1,031	\$200	5.2	\$1,031	\$793	1.3	\$941	\$2,357	0.4
IECC 2009 Builder certified - standalone: Multifamily - UT	Current	\$117	\$155	0.8	\$107	\$155	0.7	\$107	\$25	4.3	\$107	\$86	1.2	\$102	\$194	0.5
IECC 2009 Rater certified - standalone: Multifamily - UT	Current	\$117	\$190	0.6	\$107	\$190	0.6	\$107	\$25	4.3	\$107	\$86	1.2	\$102	\$238	0.4
HVAC-QI Contractor cert - standalone: Multifamily - UT	Current	\$72	\$120	0.6	\$65	\$120	0.5	\$65	\$25	2.6	\$65	\$63	1.0	\$73	\$150	0.5
HVAC-QI Contractor cert w ECM - standalone: Multifamily - UT	Retiring	\$672	\$476	1.4	\$611	\$476	1.3	\$611	\$175	3.5	\$611	\$532	1.1	\$621	\$595	1.0
HVAC-QI Rater cert - standalone: Multifamily - UT	Current	\$146	\$304	0.5	\$133	\$304	0.4	\$133	\$50	2.7	\$133	\$127	1.0	\$147	\$380	0.4
HVAC-QI Rater cert w ECM - standalone: Multifamily - UT	Retiring	\$746	\$1,047	0.7	\$678	\$1,047	0.6	\$678	\$200	3.4	\$678	\$596	1.1	\$695	\$1,309	0.5
95% AFUE Gas furnace with ECM: Multifamily - UT	New	\$292	\$320	0.9	\$266	\$320	0.8	\$266	\$150	1.8	\$266	\$495	0.5	\$581	\$400	1.5
Exterior Wall Upgrade - standalone: Multifamily - UT	Current	\$20	\$16	1.2	\$18	\$16	1.1	\$18	\$4	4.4	\$18	\$14	1.3	\$17	\$20	0.8
80% ENERGY STAR lighting < 850 sf: Multifamily - UT	Current	\$68	\$20	3.4	\$61	\$20	3.1	\$61	\$20	3.1	\$61	\$114	0.5	\$137	\$25	5.5
80% ENERGY STAR lighting 850 to 1500 sf: Multifamily - UT	Current	\$132	\$28	4.7	\$120	\$28	4.3	\$120	\$30	4.0	\$120	\$213	0.6	\$259	\$35	7.4
80% ENERGY STAR lighting > 1500 sf: Multifamily - UT	Current	\$181	\$39	4.6	\$165	\$39	4.2	\$165	\$40	4.1	\$165	\$291	0.6	\$354	\$49	7.2
60% ENERGY STAR lighting < 850 sf: Multifamily - UT	New	\$48	\$14	3.4	\$44	\$14	3.0	\$44	\$15	2.9	\$44	\$82	0.5	\$99	\$18	5.5
60% ENERGY STAR lighting 850 to 1500 sf: Multifamily - UT	New	\$94	\$20	4.7	\$86	\$20	4.3	\$86	\$20	4.3	\$86	\$150	0.6	\$183	\$25	7.3
60% ENERGY STAR lighting > 1500 sf: Multifamily - UT	New	\$130	\$28	4.6	\$118	\$28	4.2	\$118	\$30	3.9	\$118	\$210	0.6	\$254	\$35	7.3
High efficiency air conditioning = 15 SEER: Multifamily - UT	Current	\$190	\$179	1.1	\$173	\$179	1.0	\$173	\$75	2.3	\$173	\$176	1.0	\$201	\$224	0.9
Air-Source Heat Pump - 15 SEER+ (Cooling Only)	New	\$190	\$66	2.9	\$173	\$66	2.6	\$173	\$75	2.3	\$173	\$176	1.0	\$201	\$82	2.5
Air-Source Heat Pump - 15 SEER+ (Cooling/Heating)	New	\$321	\$243	1.3	\$292	\$243	1.2	\$292	\$200	1.5	\$292	\$581	0.5	\$677	\$304	2.2
Geothermal Heat Pump - standalone: Multifamily - UT	Current	\$1,409	\$16,000	0.1	\$1,281	\$16,000	0.1	\$1,281	\$1,000	1.3	\$1,281	\$2,676	0.5	\$3,095	\$20,000	0.2
Premium Evaporative Equipment: Multifamily - UT	Current	\$720	\$462	1.6	\$655	\$462	1.4	\$655	\$150	4.4	\$655	\$532	1.2	\$628	\$578	1.1
Premium Evaporative Ducted Equipment: Multifamily - UT	Current	\$794	\$824	1.0	\$722	\$824	0.9	\$722	\$300	2.4	\$722	\$722	1.0	\$827	\$1,030	0.8
Qualified efficient refrigerator- CEE Tier 3: Multifamily - UT	Current	\$82	\$104	0.8	\$74	\$104	0.7	\$74	\$20	3.7	\$74	\$116	0.6	\$139	\$130	1.1
Qualified efficient dishwasher- CEE Tier 1: Multifamily - UT	Retiring	\$32	\$65	0.5	\$29	\$65	0.4	\$29	\$10	2.9	\$29	\$48	0.6	\$58	\$81	0.7