



Memorandum

To: Angela Long, PacifiCorp/Rocky Mountain Power
From: David Basak, Navigant
Date: October 24, 2016
Re: Cost-Effectiveness Results for the Utah Home Energy Savings Program
– Low (-10%) Participation Scenario

This memo presents the cost effectiveness findings for Navigant's analysis of the Utah Home Energy Savings (HES) Program. Each scenario is analyzed using a high (+10%), expected, and low (-10%) participation with modeled assumptions provided by PacifiCorp. This memo will provide results for the low (-10%) participation with the other scenario results found in supplemental memos.

All scenarios utilize the following assumptions:

- **Avoided Costs:** Navigant performed a custom analysis of calculating avoided costs by using the *Residential Lighting, Residential Cooling, Residential Whole House, Plug Load, and Water Heating* decrements cost and the corresponding load shape based on measure type. The decrements values were populated using the 2015 PacifiCorp Integrated Resource Plan.
- **Modeling Inputs:** Navigant utilized individual measure savings and administration costs provided by PacifiCorp in the file *HES_UT_SSS_2016-09-28_v18.xlsx*.
- **Benefit/Cost Tests:** Multiple benefit/cost tests are reported including; PacifiCorp Total Resource Cost Test (PTRC), Total Resource Cost Test (TRC), Utility Cost Test (UCT), Rate Impact Test (RIM), and Participant Cost Test (PCT).
- **Status:** Navigant ran the benefit/cost tests at the measure level for every measure status ("Existing", "Revised", "New", "To be Retired") but included only "Existing", "Revised", and "New" measures in the Measure Category and Program Level summaries.

This memo will begin by addressing the program level results which include the complete list of measure categories (existing/revised/new) included in the Utah HES program. The cost-effectiveness inputs are as follows:

Table 1 - Home Energy Savings Inputs

| Parameter | Value |
|--|----------|
| Discount Rate | 6.66% |
| Residential Line Loss | 9.32% |
| Residential Energy Rate (\$/kWh)(base year 2015) | \$0.1147 |
| Inflation Rate ¹ | 1.9% |

¹ Future rates determined using a 1.9% annual escalator.

Table 2 – Home Energy Savings Annual Program Costs - Low (-10%) Participation

| Measure Group | Program Delivery Costs | RMP Internal Costs | Incentives | Total Utility Costs | Gross Customer Costs |
|---------------------|------------------------|--------------------|--------------------|---------------------|----------------------|
| Building Shell | \$12,000 | \$1,040 | \$144,000 | \$157,040 | \$785,520 |
| Energy Savings Kits | \$55,000 | \$1,878 | \$48,826 | \$105,704 | \$59,406 |
| HVAC | \$2,368,883 | \$53,498 | \$2,579,954 | \$5,002,334 | \$6,046,118 |
| Lighting | \$1,100,000 | \$237,896 | \$4,887,908 | \$6,225,804 | \$11,051,836 |
| Water Heating | \$1,117 | \$25 | \$2,037 | \$3,180 | \$3,367 |
| Whole Home | \$195,000 | \$5,663 | \$565,461 | \$766,124 | \$2,514,681 |
| All | \$3,732,000 | \$300,000 | \$8,228,186 | \$12,260,186 | \$20,460,928 |

Table 3 – Home Energy Savings – Savings by Measure Category - Low (-10%) Participation

| Measure Group | Gross kWh Savings | Realization Rate | Adjusted Gross kWh Savings | Net to Gross Ratio | Net kWh Savings | Measure Life |
|---------------------|-------------------|------------------|----------------------------|--------------------|-------------------|--------------|
| Building Shell | 206,640 | 80% | 165,312 | 100% | 165,312 | 30 |
| Energy Savings Kits | 373,059 | 100% | 373,059 | 72% | 269,111 | 12 |
| HVAC | 10,627,987 | 99% | 10,570,242 | 83% | 8,741,038 | 11 |
| Lighting | 47,260,805 | 100% | 47,260,805 | 61% | 28,829,091 | 12 |
| Water Heating | 5,011 | 100% | 5,011 | 83% | 4,159 | 13 |
| Whole Home | 1,125,108 | 100% | 1,125,108 | 81% | 905,757 | 28 |
| All | 59,598,611 | 100% | 59,499,538 | 65% | 38,914,469 | 19 |

Table 4 - Benefit/Cost Ratios by Measure Category - Low (-10%) Participation

| Measure Group | PTRC | TRC | UCT | RIM | PCT |
|---------------------|-------------|-------------|-------------|-------------|-------------|
| Building Shell | 0.34 | 0.31 | 1.58 | 0.52 | 0.59 |
| Energy Savings Kits | 1.65 | 1.50 | 1.40 | 0.33 | 8.66 |
| HVAC | 0.80 | 0.72 | 1.08 | 0.35 | 2.47 |
| Lighting | 2.41 | 2.19 | 2.84 | 0.47 | 5.17 |
| Water Heating | 0.68 | 0.62 | 0.77 | 0.30 | 2.35 |
| Whole Home | 0.64 | 0.58 | 1.69 | 0.53 | 1.06 |
| All | 1.46 | 1.33 | 2.02 | 0.44 | 3.70 |

Table 5 – HES Program Level Cost-Effectiveness Results - Low (-10%) Participation

| Cost-Effectiveness Test | Levelized \$/kWh | Costs | Benefits | Net Benefits | Benefit/Cost Ratio |
|--|------------------|--------------|--------------|---------------|--------------------|
| Total Resource Cost Test (PTRC) + Conservation Adder | \$0.0516 | \$18,634,224 | \$27,265,290 | \$8,631,066 | 1.46 |
| Total Resource Cost Test (TRC) No Adder | \$0.0516 | \$18,634,224 | \$24,786,627 | \$6,152,404 | 1.33 |
| Utility Cost Test (UCT) | \$0.0339 | \$12,260,186 | \$24,786,627 | \$12,526,441 | 2.02 |
| Rate Impact Test (RIM) | | \$56,711,170 | \$24,786,627 | -\$31,924,543 | 0.44 |
| Participant Cost Test (PCT) | | \$20,460,928 | \$75,735,333 | \$55,274,404 | 3.70 |
| Lifecycle Revenue Impacts (\$/kWh) | | | | | \$0.0001248181 |
| Discounted Participant Payback (years) | | | | | 2.81 |

Table 6 through Table 11 provides cost-effectiveness results with administration costs for all 6 measure categories followed by Tables 12-14 showing measure level results without administration costs.

**Table 6 - HES Building Shell Cost-Effectiveness Results - Low (-10%) Participation
 (Decrement - East Residential Whole House - 31%, Load Shape – Cooling)**

| Cost-Effectiveness Test | Levelized \$/kWh | Costs | Benefits | Net Benefits | Benefit/Cost Ratio |
|--|------------------|-----------|-----------|--------------|--------------------|
| Total Resource Cost Test (PTRC) + Conservation Adder | \$0.3057 | \$798,560 | \$273,733 | -\$524,827 | 0.34 |
| Total Resource Cost Test (TRC) No Adder | \$0.3057 | \$798,560 | \$248,848 | -\$549,712 | 0.31 |
| Utility Cost Test (UCT) | \$0.0601 | \$157,040 | \$248,848 | \$91,808 | 1.58 |
| Rate Impact Test (RIM) | | \$480,042 | \$248,848 | -\$231,194 | 0.52 |
| Participant Cost Test (PCT) | | \$785,520 | \$467,002 | -\$318,518 | 0.59 |
| Lifecycle Revenue Impacts (\$/kWh) | | | | | \$0.0000003300 |
| Discounted Participant Payback (years) | | | | | n/a |

**Table 7 - HES Energy Kits Cost-Effectiveness Results - Low (-10%) Participation
(Decrement - East Residential Lighting - 47%, Load Shape – Lighting)**

| Cost-Effectiveness Test | Levelized \$/kWh | Costs | Benefits | Net Benefits | Benefit/Cost Ratio |
|--|------------------|-----------|-----------|--------------|--------------------|
| Total Resource Cost Test (PTRC) + Conservation Adder | \$0.0356 | \$98,360 | \$162,299 | \$63,939 | 1.65 |
| Total Resource Cost Test (TRC) No Adder | \$0.0356 | \$98,360 | \$147,545 | \$49,184 | 1.50 |
| Utility Cost Test (UCT) | \$0.0383 | \$105,704 | \$147,545 | \$41,841 | 1.40 |
| Rate Impact Test (RIM) | | \$445,617 | \$147,545 | -\$298,073 | 0.33 |
| Participant Cost Test (PCT) | | \$59,406 | \$514,242 | \$454,836 | 8.66 |
| Lifecycle Revenue Impacts (\$/kWh) | | | | | \$0.0000011654 |
| Discounted Participant Payback (years) | | | | | 0.34 |

*Water heating measures utilized the water heating decrement with the water heating load shape.

**Table 8 - HES HVAC Cost-Effectiveness Results - Low (-10%) Participation
(Decrement - East Residential Whole House - 31%, Load Shape – Heat Pump)**

| Cost-Effectiveness Test | Levelized \$/kWh | Costs | Benefits | Net Benefits | Benefit/Cost Ratio |
|--|------------------|--------------|--------------|--------------|--------------------|
| Total Resource Cost Test (PTRC) + Conservation Adder | \$0.0894 | \$7,432,620 | \$5,920,499 | -\$1,512,121 | 0.80 |
| Total Resource Cost Test (TRC) No Adder | \$0.0894 | \$7,432,620 | \$5,382,272 | -\$2,050,348 | 0.72 |
| Utility Cost Test (UCT) | \$0.0602 | \$5,002,334 | \$5,382,272 | \$379,938 | 1.08 |
| Rate Impact Test (RIM) | | \$15,234,712 | \$5,382,272 | -\$9,852,440 | 0.35 |
| Participant Cost Test (PCT) | | \$6,046,118 | \$14,960,685 | \$8,914,567 | 2.47 |
| Lifecycle Revenue Impacts (\$/kWh) | | | | | \$0.0000427449 |
| Discounted Participant Payback (years) | | | | | 3.60 |

**Table 9 - HES Lighting Cost-Effectiveness Results - Low (-10%) Participation
(Decrement - East Residential Lighting - 47%, Load Shape – Lighting)**

| Cost-Effectiveness Test | Levelized \$/kWh | Costs | Benefits | Net Benefits | Benefit/Cost Ratio |
|--|------------------|--------------|--------------|---------------|--------------------|
| Total Resource Cost Test (PTRC) + Conservation Adder | \$0.0312 | \$8,079,516 | \$19,483,005 | \$11,403,489 | 2.41 |
| Total Resource Cost Test (TRC) No Adder | \$0.0312 | \$8,079,516 | \$17,711,822 | \$9,632,307 | 2.19 |
| Utility Cost Test (UCT) | \$0.0240 | \$6,225,804 | \$17,711,822 | \$11,486,019 | 2.84 |
| Rate Impact Test (RIM) | | \$38,084,379 | \$17,711,822 | -\$20,372,557 | 0.47 |
| Participant Cost Test (PCT) | | \$11,051,836 | \$57,115,081 | \$46,063,244 | 5.17 |
| Lifecycle Revenue Impacts (\$/kWh) | | | | | \$0.0000796523 |
| Discounted Participant Payback (years) | | | | | 1.87 |

**Table 10 - HES Water Heating Cost-Effectiveness Results - Low (-10%) Participation
 (Decrement - East Water Heating - 53%, Load Shape – Water Heating)**

| Cost-Effectiveness Test | Levelized \$/kWh | Costs | Benefits | Net Benefits | Benefit/Cost Ratio |
|--|------------------|---------|----------|--------------|--------------------|
| Total Resource Cost Test (PTRC) + Conservation Adder | \$0.0993 | \$3,937 | \$2,686 | -\$1,251 | 0.68 |
| Total Resource Cost Test (TRC) No Adder | \$0.0993 | \$3,937 | \$2,441 | -\$1,495 | 0.62 |
| Utility Cost Test (UCT) | \$0.0802 | \$3,180 | \$2,441 | -\$738 | 0.77 |
| Rate Impact Test (RIM) | | \$8,057 | \$2,441 | -\$5,615 | 0.30 |
| Participant Cost Test (PCT) | | \$3,367 | \$7,914 | \$4,546 | 2.35 |
| Lifecycle Revenue Impacts (\$/kWh) | | | | | \$0.000000200 |
| Discounted Participant Payback (years) | | | | | 2.86 |

**Table 11 - HES Whole Home Cost-Effectiveness Results - Low (-10%) Participation
 (Decrement - East Residential Whole House - 31%, Load Shape – Residential Whole House)**

| Cost-Effectiveness Test | Levelized \$/kWh | Costs | Benefits | Net Benefits | Benefit/Cost Ratio |
|--|------------------|-------------|-------------|--------------|--------------------|
| Total Resource Cost Test (PTRC) + Conservation Adder | \$0.1622 | \$2,221,231 | \$1,423,068 | -\$798,162 | 0.64 |
| Total Resource Cost Test (TRC) No Adder | \$0.1622 | \$2,221,231 | \$1,293,699 | -\$927,532 | 0.58 |
| Utility Cost Test (UCT) | \$0.0560 | \$766,124 | \$1,293,699 | \$527,574 | 1.69 |
| Rate Impact Test (RIM) | | \$2,458,362 | \$1,293,699 | -\$1,164,664 | 0.53 |
| Participant Cost Test (PCT) | | \$2,514,681 | \$2,670,410 | \$155,729 | 1.06 |
| Lifecycle Revenue Impacts (\$/kWh) | | | | | \$0.0000017881 |
| Discounted Participant Payback (years) | | | | | 32.34 |

Table 12 - HES Measure Level Cost-Effectiveness Results - Prior to Participation

| Cost-Effectiveness Test | 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 | Participant PV Benefits (\$) | Participant PV Cost (\$) | Participant Cost Test |
|---|---------------|---------------------|------------------|------------|-------------------|----------------|----------|--------------------------|-----------------------|-------------------|----------------------------|-------------------------|----------|------------------------------|--------------------------|-----------------------|
| 95% Gas Furnace with ECM Blower - UT | Revised | \$320 | \$320 | 1.00 | \$291 | \$320 | 0.91 | \$291 | \$150 | 1.94 | \$291 | \$660 | 0.44 | \$787 | \$400 | 1.97 |
| Advanced Power Strip - Infrared Sensing - Owner Installed - UT | Revised | \$38 | \$29 | 1.30 | \$35 | \$29 | 1.18 | \$35 | \$32 | 1.09 | \$35 | \$124 | 0.28 | \$147 | \$37 | 4.00 |
| Advanced Power Strip - Load Sensing - Owner Installed - UT | Revised | \$5 | \$22 | 0.24 | \$5 | \$22 | 0.22 | \$5 | \$10 | 0.48 | \$5 | \$23 | 0.21 | \$26 | \$28 | 0.95 |
| Advanced Power Strip - Occupancy Sensing - Owner Installed - UT | Revised | \$12 | \$28 | 0.44 | \$11 | \$28 | 0.40 | \$11 | \$32 | 0.35 | \$11 | \$62 | 0.18 | \$69 | \$35 | 1.99 |
| Air Sealing - Electric Heat - UT | To be retired | \$1 | \$0 | 2.24 | \$0 | \$0 | 2.03 | \$0 | \$0 | 2.44 | \$0 | \$1 | 0.47 | \$1 | \$0 | 4.29 |
| CAC Proper Install & Sizing | To be retired | \$532 | \$0 | 0.00 | \$484 | \$0 | 0.00 | \$484 | \$150 | 3.22 | \$484 | \$404 | 1.20 | \$456 | \$0 | 0.00 |
| Central Air Conditioner - Tier 1 - 15 to 16.9 SEER - UT | Revised | \$755 | \$251 | 3.01 | \$686 | \$251 | 2.74 | \$686 | \$125 | 5.49 | \$686 | \$493 | 1.39 | \$568 | \$302 | 1.88 |
| Central Air Conditioner - Tier 2 - 17 to 19.9 SEER - UT | Revised | \$1,173 | \$1,299 | 0.90 | \$1,066 | \$1,299 | 0.82 | \$1,066 | \$200 | 5.33 | \$1,066 | \$771 | 1.38 | \$888 | \$1,565 | 0.57 |
| Central Air Conditioner - Tier 3 - 20 SEER or greater - UT | Revised | \$1,642 | \$2,905 | 0.57 | \$1,493 | \$2,905 | 0.51 | \$1,493 | \$300 | 4.98 | \$1,493 | \$1,100 | 1.36 | \$1,264 | \$3,500 | 0.36 |
| Clothes Washers - 3.2 MEF or Higher | To be retired | \$62 | \$190 | 0.33 | \$56 | \$190 | 0.30 | \$56 | \$50 | 1.13 | \$56 | \$179 | 0.32 | \$209 | \$235 | 0.89 |
| Duct Sealing & Insulation - Electric Cooling - UT | To be retired | \$771 | \$671 | 1.15 | \$701 | \$671 | 1.05 | \$701 | \$120 | 5.84 | \$701 | \$490 | 1.43 | \$565 | \$808 | 0.70 |
| Duct Sealing & Insulation - Electric Heat - UT | To be retired | \$6,689 | \$671 | 9.97 | \$6,081 | \$671 | 9.07 | \$6,081 | \$800 | 7.60 | \$6,081 | \$4,008 | 1.52 | \$4,665 | \$808 | 5.77 |
| Duct Sealing Only - Electric Heat - UT | To be retired | \$3,004 | \$447 | 6.73 | \$2,731 | \$447 | 6.12 | \$2,731 | \$400 | 6.83 | \$2,731 | \$1,841 | 1.48 | \$2,136 | \$538 | 3.97 |
| Ductless Heat Pump - Multi-Head - UT | Revised | \$12,512 | \$5,130 | 2.44 | \$11,374 | \$5,130 | 2.22 | \$11,374 | \$1,800 | 6.32 | \$11,374 | \$7,896 | 1.44 | \$9,144 | \$6,181 | 1.48 |
| Ductless Heat Pump - Single-Head - UT | Revised | \$6,249 | \$2,788 | 2.24 | \$5,681 | \$2,788 | 2.04 | \$5,681 | \$1,000 | 5.68 | \$5,681 | \$4,045 | 1.40 | \$4,668 | \$3,359 | 1.39 |
| Ductless Heat Pump - Supplemental Heat - UT | Revised | \$2,091 | \$2,321 | 0.90 | \$1,901 | \$2,321 | 0.82 | \$1,901 | \$350 | 5.43 | \$1,901 | \$1,369 | 1.39 | \$1,578 | \$2,796 | 0.56 |
| ECM on Existing Furnace - UT | Revised | \$690 | \$332 | 2.08 | \$628 | \$332 | 1.89 | \$628 | \$150 | 4.18 | \$628 | \$486 | 1.29 | \$555 | \$400 | 1.39 |
| Evaporative Cooler - >= 2,000 CFM - Portable - UT | Revised | \$1,343 | \$120 | 11.18 | \$1,221 | \$120 | 10.16 | \$1,221 | \$200 | 6.11 | \$1,221 | \$838 | 1.46 | \$969 | \$145 | 6.69 |
| Evaporative Cooler - Min 3,500 CFM - New - Self Install - UT | Revised | \$978 | -\$919 | 0.00 | \$889 | -\$919 | 0.00 | \$889 | \$300 | 2.96 | \$889 | \$1,884 | 0.47 | \$2,280 | -\$1,149 | 0.00 |
| Evaporative Cooler - Min 3,500 CFM - New - UT | Revised | \$3,372 | -\$954 | 0.00 | \$3,066 | -\$954 | 0.00 | \$3,066 | \$400 | 7.66 | \$3,066 | \$2,043 | 1.50 | \$2,380 | -\$1,149 | 0.00 |
| Evaporative Cooler - Min 3,500 CFM - Premium Only - Self Install - UT | Revised | \$3,372 | -\$954 | 0.00 | \$3,066 | -\$954 | 0.00 | \$3,066 | \$400 | 7.66 | \$3,066 | \$2,043 | 1.50 | \$2,380 | -\$1,149 | 0.00 |
| Evaporative Cooler - Min 3,500 CFM - Premium Only - UT | Revised | \$3,372 | -\$954 | 0.00 | \$3,066 | -\$954 | 0.00 | \$3,066 | \$450 | 6.81 | \$3,066 | \$2,093 | 1.46 | \$2,430 | -\$1,149 | 0.00 |
| Evaporative Cooler - Min 3,500 CFM - Premium Whole-House Ducted - Self Install - UT | To be retired | \$0 | -\$1,353 | 0.00 | \$0 | -\$1,353 | 0.00 | \$0 | \$0 | 0.00 | \$0 | \$0 | 0.00 | \$0 | -\$1,630 | 0.00 |
| Evaporative Cooler - Min 3,500 CFM - Premium Whole-House Ducted - UT | To be retired | \$0 | -\$1,353 | 0.00 | \$0 | -\$1,353 | 0.00 | \$0 | \$0 | 0.00 | \$0 | \$0 | 0.00 | \$0 | -\$1,630 | 0.00 |
| Evaporative Cooler - Min 3,500 CFM - Replacement - Self Install - UT | Revised | \$3,372 | -\$954 | 0.00 | \$3,066 | -\$954 | 0.00 | \$3,066 | \$300 | 10.22 | \$3,066 | \$1,943 | 1.58 | \$2,280 | -\$1,149 | 0.00 |
| Evaporative Cooler - Min 3,500 CFM - Replacement - UT | Revised | \$3,372 | -\$954 | 0.00 | \$3,066 | -\$954 | 0.00 | \$3,066 | \$400 | 7.66 | \$3,066 | \$2,043 | 1.50 | \$2,380 | -\$1,149 | 0.00 |
| Freezer - ENERGY STAR - Any Style - UT | To be retired | \$52 | \$18 | 2.90 | \$47 | \$18 | 2.64 | \$47 | \$50 | 0.94 | \$47 | \$150 | 0.31 | \$174 | \$22 | 7.89 |
| Heat Pump Conversion - Tier 1 - 9.0 HSPF and 15 SEER - UT | Revised | \$20,478 | \$2,810 | 7.29 | \$18,616 | \$2,810 | 6.63 | \$18,616 | \$750 | 24.82 | \$18,616 | \$10,727 | 1.74 | \$12,771 | \$3,385 | 3.77 |
| Heat Pump Conversion - Tier 2 - 9.5 HSPF and 16 SEER - UT | Revised | \$19,505 | \$3,434 | 5.68 | \$17,732 | \$3,434 | 5.16 | \$17,732 | \$850 | 20.86 | \$17,732 | \$10,353 | 1.71 | \$12,299 | \$4,137 | 2.97 |
| Heat Pump Upgrade - Tier 1 - 9.0 HSPF and 15 SEER - UT | Revised | \$1,755 | \$515 | 3.41 | \$1,595 | \$515 | 3.10 | \$1,595 | \$250 | 6.38 | \$1,595 | \$1,105 | 1.44 | \$1,280 | \$620 | 2.06 |
| Heat Pump Upgrade - Tier 2 - 9.5 HSPF and 16 SEER - UT | Revised | \$2,711 | \$1,139 | 2.38 | \$2,464 | \$1,139 | 2.16 | \$2,464 | \$450 | 5.48 | \$2,464 | \$1,771 | 1.39 | \$2,041 | \$1,372 | 1.49 |
| HPWH - Tier 1 - 0-55 Gallons | New | \$615 | \$640 | 0.96 | \$559 | \$640 | 0.87 | \$559 | \$575 | 0.97 | \$559 | \$1,692 | 0.33 | \$1,921 | \$771 | 2.49 |
| HPWH - Tier 1 - 0-55 Gallons - Self Install | New | \$615 | \$640 | 0.96 | \$559 | \$640 | 0.87 | \$559 | \$400 | 1.40 | \$559 | \$1,517 | 0.37 | \$1,746 | \$771 | 2.26 |
| HPWH - Tier 2 and above - 0-55 Gallons | New | \$793 | \$652 | 1.22 | \$721 | \$652 | 1.10 | \$721 | \$700 | 1.03 | \$721 | \$2,140 | 0.34 | \$2,435 | \$786 | 3.10 |
| HPWH - Tier 2 and above - 0-55 Gallons - Self Install | New | \$793 | \$652 | 1.22 | \$721 | \$652 | 1.10 | \$721 | \$550 | 1.31 | \$721 | \$1,990 | 0.36 | \$2,285 | \$786 | 2.91 |
| Insulation - Attic - Electric Cooling - UT | To be retired | \$0 | \$1 | 0.16 | \$0 | \$1 | 0.14 | \$0 | \$0 | 1.20 | \$0 | \$0 | 0.39 | \$0 | \$1 | 0.36 |
| Insulation - Attic - Electric Heat - UT | To be retired | \$1 | \$1 | 1.45 | \$1 | \$1 | 1.32 | \$1 | \$1 | 1.70 | \$1 | \$3 | 0.44 | \$3 | \$1 | 3.01 |
| Insulation - Attic - Self Install - Electric Cooling - UT | To be retired | \$0 | \$0 | 0.31 | \$0 | \$0 | 0.28 | \$0 | \$0 | 1.20 | \$0 | \$0 | 0.39 | \$0 | \$0 | 0.72 |
| Insulation - Attic - Self Install - Electric Heat - UT | To be retired | \$1 | \$0 | 2.89 | \$1 | \$0 | 2.63 | \$1 | \$0 | 2.76 | \$1 | \$2 | 0.49 | \$2 | \$0 | 5.42 |
| Insulation - Floor - Electric Heat - UT | To be retired | \$4 | \$1 | 2.62 | \$3 | \$1 | 2.38 | \$3 | \$1 | 5.01 | \$3 | \$6 | 0.53 | \$6 | \$1 | 4.51 |
| Insulation - Floor - Self Install - Electric Heat - UT | To be retired | \$4 | \$1 | 2.62 | \$3 | \$1 | 2.38 | \$3 | \$0 | 13.04 | \$3 | \$6 | 0.56 | \$6 | \$1 | 4.22 |
| Insulation - Wall - Electric Cooling - UT | To be retired | \$0 | \$1 | 0.48 | \$0 | \$1 | 0.44 | \$0 | \$0 | 1.69 | \$0 | \$1 | 0.44 | \$1 | \$1 | 1.00 |
| Insulation - Wall - Electric Heat - UT | To be retired | \$5 | \$1 | 5.04 | \$4 | \$1 | 4.58 | \$4 | \$1 | 6.84 | \$4 | \$8 | 0.54 | \$8 | \$1 | 8.45 |
| Insulation - Wall - Self Install - Electric Cooling - UT | To be retired | \$0 | \$0 | 0.95 | \$0 | \$0 | 0.86 | \$0 | \$0 | 2.12 | \$0 | \$1 | 0.46 | \$1 | \$0 | 1.88 |
| Insulation - Wall - Self Install - Electric Heat - UT | To be retired | \$5 | \$0 | 9.98 | \$4 | \$0 | 9.07 | \$4 | \$0 | 9.88 | \$4 | \$8 | 0.56 | \$8 | \$0 | 16.33 |

Table 13 - HES Measure Level Cost-Effectiveness Results - Prior to Participation

| Cost-Effectiveness Test | 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 | Participant PV Benefits (\$) | Participant PV Cost (\$) | Participant Cost Test |
|--|---------------|---------------------|------------------|------------|-------------------|----------------|----------|--------------------------|-----------------------|-------------------|----------------------------|-------------------------|----------|------------------------------|--------------------------|-----------------------|
| LED Downlight - All Channels | Revised | \$14 | \$2 | 6.14 | \$12 | \$2 | 5.58 | \$12 | \$3 | 4.16 | \$12 | \$25 | 0.49 | \$40 | \$4 | 10.85 |
| LED Fixture - ENERGY STAR - Upstream | New | \$12 | \$6 | 1.97 | \$11 | \$6 | 1.79 | \$11 | \$5 | 2.18 | \$11 | \$25 | 0.44 | \$37 | \$10 | 3.72 |
| LED General Purpose - All Channels | Revised | \$8 | \$3 | 2.33 | \$7 | \$3 | 2.12 | \$7 | \$2 | 3.65 | \$7 | \$15 | 0.48 | \$24 | \$6 | 4.17 |
| LED Specialty - All Channels | Revised | \$9 | \$3 | 3.46 | \$8 | \$3 | 3.15 | \$8 | \$3 | 2.63 | \$8 | \$17 | 0.46 | \$26 | \$4 | 6.39 |
| Manufactured Home Duct Sealing - Direct Install - Electric Heat - UT | Revised | \$2,601 | \$378 | 6.89 | \$2,364 | \$378 | 6.26 | \$2,364 | \$500 | 4.73 | \$2,364 | \$1,753 | 1.35 | \$2,010 | \$455 | 4.42 |
| Manufactured Home Ductless Heat Pump - Multi-Head - UT | Revised | \$12,512 | \$5,130 | 2.44 | \$11,374 | \$5,130 | 2.22 | \$11,374 | \$1,800 | 6.32 | \$11,374 | \$7,896 | 1.44 | \$9,144 | \$6,181 | 1.48 |
| Manufactured Home Ductless Heat Pump - Single-Head - UT | Revised | \$6,249 | \$2,788 | 2.24 | \$5,681 | \$2,788 | 2.04 | \$5,681 | \$1,300 | 4.37 | \$5,681 | \$4,345 | 1.31 | \$4,968 | \$3,359 | 1.48 |
| Manufactured Home Ductless Heat Pump - Supplemental Heat - UT | Revised | \$2,091 | \$2,321 | 0.90 | \$1,901 | \$2,321 | 0.82 | \$1,901 | \$350 | 5.43 | \$1,901 | \$1,369 | 1.39 | \$1,578 | \$2,796 | 0.56 |
| Manufactured Home Heat Pump Conversion - 9.0 HSPF and 15 SEER - UT | To be retired | \$8,787 | \$2,810 | 3.13 | \$7,988 | \$2,810 | 2.84 | \$7,988 | \$500 | 15.98 | \$7,988 | \$4,781 | 1.67 | \$5,658 | \$3,385 | 1.67 |
| Manufactured Home Heat Pump Conversion - Tier 2 - 9.5 HSPF and 16 SEER | To be retired | \$9,197 | \$3,434 | 2.68 | \$8,361 | \$3,434 | 2.43 | \$8,361 | \$400 | 20.90 | \$8,361 | \$4,881 | 1.71 | \$5,799 | \$4,137 | 1.40 |
| Manufactured Home Heat Pump Upgrade - 9.0 HSPF and 15 SEER - UT | To be retired | \$1,078 | \$515 | 2.09 | \$980 | \$515 | 1.90 | \$980 | \$250 | 3.92 | \$980 | \$775 | 1.26 | \$883 | \$620 | 1.42 |
| Manufactured Home Heat Pump Upgrade - Tier 2 - 9.5 HSPF and 16 SEER | To be retired | \$1,902 | \$1,139 | 1.67 | \$1,729 | \$1,139 | 1.52 | \$1,729 | \$400 | 4.32 | \$1,729 | \$1,316 | 1.31 | \$1,504 | \$1,372 | 1.10 |
| Multifamily - Ductless Heat Pump - UT | New | \$2,779 | \$2,788 | 1.00 | \$2,527 | \$2,788 | 0.91 | \$2,527 | \$400 | 6.32 | \$2,527 | \$1,754 | 1.44 | \$2,032 | \$3,359 | 0.60 |
| Multifamily - Evaporative Cooler - >= 2,000 CFM - UT | New | \$103 | \$116 | 0.89 | \$94 | \$116 | 0.81 | \$94 | \$100 | 0.94 | \$94 | \$274 | 0.34 | \$318 | \$145 | 2.20 |
| Multifamily Air Sealing - Electric Heat - UT | To be retired | \$0 | \$0 | 1.94 | \$0 | \$0 | 1.76 | \$0 | \$0 | 2.12 | \$0 | \$1 | 0.46 | \$1 | \$0 | 3.83 |
| Multifamily New Homes - 95% AFUE or higher Gas Furnace with ECM | New | \$655 | \$332 | 1.97 | \$596 | \$332 | 1.79 | \$596 | \$100 | 5.96 | \$596 | \$416 | 1.43 | \$480 | \$400 | 1.20 |
| Multifamily New Homes - Central Air Conditioner 15 SEER or higher | New | \$235 | \$186 | 1.26 | \$213 | \$186 | 1.15 | \$213 | \$75 | 2.84 | \$213 | \$189 | 1.13 | \$213 | \$224 | 0.95 |
| Multifamily New Homes - ENERGY STAR 3.0 Certification | New | \$151 | \$125 | 1.20 | \$137 | \$125 | 1.09 | \$137 | \$20 | 6.85 | \$137 | \$91 | 1.50 | \$106 | \$151 | 0.70 |
| Multifamily New Homes - HERS Index 48 or lower - Gas Heat | New | \$662 | \$817 | 0.81 | \$602 | \$817 | 0.74 | \$602 | \$300 | 2.01 | \$602 | \$1,322 | 0.46 | \$1,578 | \$1,021 | 1.55 |
| Multifamily New Homes - HERS Index 48 or lower - Electric Heat | New | \$1,759 | \$817 | 2.15 | \$1,599 | \$817 | 1.96 | \$1,599 | \$600 | 2.67 | \$1,599 | \$3,315 | 0.48 | \$3,994 | \$1,021 | 3.91 |
| Multifamily New Homes - HERS Index 55 or lower - Electric Heat | New | \$1,173 | \$545 | 2.15 | \$1,066 | \$545 | 1.96 | \$1,066 | \$400 | 2.67 | \$1,066 | \$2,210 | 0.48 | \$2,663 | \$681 | 3.91 |
| Multifamily New Homes - HERS Index 55 or lower - Gas Heat | New | \$442 | \$545 | 0.81 | \$401 | \$545 | 0.74 | \$401 | \$200 | 2.01 | \$401 | \$882 | 0.46 | \$1,052 | \$681 | 1.54 |
| Multifamily New Homes - HERS Index 62 or lower - Electric Heat | New | \$586 | \$272 | 2.16 | \$533 | \$272 | 1.96 | \$533 | \$200 | 2.67 | \$533 | \$1,105 | 0.48 | \$1,331 | \$340 | 3.92 |
| Multifamily New Homes - HERS Index 62 or lower - Gas Heat | New | \$221 | \$272 | 0.81 | \$201 | \$272 | 0.74 | \$201 | \$100 | 2.01 | \$201 | \$441 | 0.46 | \$526 | \$340 | 1.55 |
| New Homes - 95% Gas Furnace with ECM Blower - UT | New | \$680 | \$332 | 2.05 | \$618 | \$332 | 1.86 | \$618 | \$150 | 4.12 | \$618 | \$478 | 1.29 | \$545 | \$400 | 1.36 |
| New Homes - Central Air Conditioner 15 SEER or higher | New | \$396 | \$251 | 1.58 | \$360 | \$251 | 1.44 | \$360 | \$100 | 3.60 | \$360 | \$293 | 1.23 | \$333 | \$302 | 1.10 |
| New Homes - ENERGY STAR 3.0 Certification | New | \$81 | \$121 | 0.67 | \$74 | \$121 | 0.61 | \$74 | \$25 | 2.95 | \$74 | \$150 | 0.49 | \$181 | \$151 | 1.20 |
| New Homes - HERS Index 48 or lower - Electric Heat | New | \$3,122 | \$2,058 | 1.52 | \$2,838 | \$2,058 | 1.38 | \$2,838 | \$1,000 | 2.84 | \$2,838 | \$5,819 | 0.49 | \$7,024 | \$2,573 | 2.73 |
| New Homes - HERS Index 48 or lower - Gas Heat | New | \$1,024 | \$2,058 | 0.50 | \$931 | \$2,058 | 0.45 | \$931 | \$500 | 1.86 | \$931 | \$2,080 | 0.45 | \$2,475 | \$2,573 | 0.96 |
| New Homes - HERS Index 55 or lower - Electric Heat | New | \$2,081 | \$1,372 | 1.52 | \$1,892 | \$1,372 | 1.38 | \$1,892 | \$600 | 3.15 | \$1,892 | \$3,812 | 0.50 | \$4,615 | \$1,715 | 2.69 |
| New Homes - HERS Index 55 or lower - Gas Heat | New | \$683 | \$1,372 | 0.50 | \$620 | \$1,372 | 0.45 | \$620 | \$300 | 2.07 | \$620 | \$1,354 | 0.46 | \$1,617 | \$1,715 | 0.94 |
| New Homes - HERS Index 62 or lower - Electric Heat | New | \$1,041 | \$686 | 1.52 | \$946 | \$686 | 1.38 | \$946 | \$350 | 2.70 | \$946 | \$1,957 | 0.48 | \$2,359 | \$858 | 2.75 |
| New Homes - HERS Index 62 or lower - Gas Heat | New | \$341 | \$686 | 0.50 | \$310 | \$686 | 0.45 | \$310 | \$175 | 1.77 | \$310 | \$702 | 0.44 | \$833 | \$858 | 0.97 |
| New Manufactured Home - Energy Star - Gas Furnace - UT | To be retired | \$1,462 | \$1,143 | 1.28 | \$1,329 | \$1,143 | 1.16 | \$1,329 | \$500 | 2.66 | \$1,329 | \$1,194 | 1.11 | \$1,336 | \$1,377 | 0.97 |
| New Manufactured Home - ENERGY Star Electric Heat | To be retired | \$13,792 | \$1,143 | 12.07 | \$12,538 | \$1,143 | 10.97 | \$12,538 | \$1,000 | 12.54 | \$12,538 | \$7,553 | 1.66 | \$8,895 | \$1,377 | 6.46 |

Table 14 - HES Measure Level Cost-Effectiveness Results – Prior to Participation

| Cost-Effectiveness Test | 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 | Participant PV Benefits (\$) | Participant PV Cost (\$) | Participant Cost Test |
|--|-----------------|---------------------|------------------|-------------|-------------------|----------------|-------------|--------------------------|-----------------------|-------------------|----------------------------|-------------------------|-------------|------------------------------|--------------------------|-----------------------|
| Refrigerator - CEE Tier 3 - Any Style - UT | To be retired | \$101 | \$62 | 1.64 | \$92 | \$62 | 1.49 | \$92 | \$100 | 0.92 | \$92 | \$305 | 0.30 | \$353 | \$77 | 4.61 |
| Room Air Conditioner - ENERGY STAR - UT | Existing | \$38 | \$42 | 0.91 | \$34 | \$42 | 0.83 | \$34 | \$20 | 1.72 | \$34 | \$88 | 0.39 | \$101 | \$50 | 2.03 |
| Smart T-stat - Electric Cooling | New | \$44 | \$208 | 0.21 | \$40 | \$208 | 0.19 | \$40 | \$25 | 1.60 | \$40 | \$103 | 0.39 | \$119 | \$250 | 0.48 |
| Smart T-stat - Electric Heat | New | \$488 | \$208 | 2.35 | \$444 | \$208 | 2.14 | \$444 | \$100 | 4.44 | \$444 | \$966 | 0.46 | \$1,143 | \$250 | 4.57 |
| Whole Home Upgrade Package - Ductless Heat Pump - UT | To be retired | \$0 | \$0 | 0.00 | \$0 | \$0 | 0.00 | \$0 | \$1,000 | 0.00 | \$0 | \$1,000 | 0.00 | \$1,000 | \$0 | 0.00 |
| Whole Home Upgrade Package - Electric Cooling | To be retired | \$0 | \$0 | 0.00 | \$0 | \$0 | 0.00 | \$0 | \$1,000 | 0.00 | \$0 | \$1,000 | 0.00 | \$1,000 | \$0 | 0.00 |
| Whole Home Upgrade Package - Heat Pump Conversion - UT | To be retired | \$0 | \$0 | 0.00 | \$0 | \$0 | 0.00 | \$0 | \$1,000 | 0.00 | \$0 | \$1,000 | 0.00 | \$1,000 | \$0 | 0.00 |
| Whole Home Upgrade Package - Heat Pump Upgrade - UT | To be retired | \$0 | \$0 | 0.00 | \$0 | \$0 | 0.00 | \$0 | \$1,000 | 0.00 | \$0 | \$1,000 | 0.00 | \$1,000 | \$0 | 0.00 |
| Windows - Tier 1 - U-0.30 - Electric Cooling - UT | To be retired | \$1 | \$1 | 1.21 | \$1 | \$1 | 1.10 | \$1 | \$1 | 1.95 | \$1 | \$2 | 0.45 | \$2 | \$1 | 2.42 |
| Windows - Tier 2 - U-0.22 - Electric Cooling - UT | To be retired | \$1 | \$2 | 0.50 | \$1 | \$2 | 0.45 | \$1 | \$1 | 1.02 | \$1 | \$3 | 0.37 | \$3 | \$2 | 1.22 |
| Windows - Tier 2 - U-0.22 - Electric Heat - UT | To be retired | \$2 | \$2 | 1.08 | \$2 | \$2 | 0.98 | \$2 | \$2 | 1.10 | \$2 | \$6 | 0.38 | \$6 | \$2 | 2.55 |
| Attic Insulation - Questar | New | \$0 | \$1 | 0.27 | \$0 | \$1 | 0.25 | \$0 | \$0 | 1.57 | \$0 | \$0 | 0.52 | \$0 | \$1 | 0.48 |
| Wall Insulation - Questar | New | \$1 | \$1 | 0.83 | \$1 | \$1 | 0.76 | \$1 | \$0 | 2.22 | \$1 | \$1 | 0.57 | \$1 | \$1 | 1.33 |
| 10 W LED | Existing | \$42 | \$16 | 2.61 | \$38 | \$16 | 2.38 | \$38 | \$13 | 2.86 | \$38 | \$82 | 0.46 | \$99 | \$20 | 4.98 |
| 1.5 GPM Kitchen Aerator | Existing | \$11 | \$2 | 6.81 | \$10 | \$2 | 6.19 | \$10 | \$1 | 7.45 | \$10 | \$23 | 0.46 | \$28 | \$2 | 13.36 |
| .5 GPM Bathroom Aerator | Existing | \$28 | \$0 | 63.15 | \$25 | \$0 | 57.41 | \$25 | \$0 | 69.06 | \$25 | \$52 | 0.48 | \$65 | \$1 | 118.37 |
| 1.5 GPM Showerhead | Existing | \$104 | \$19 | 5.41 | \$94 | \$19 | 4.92 | \$94 | \$16 | 5.92 | \$94 | \$210 | 0.45 | \$258 | \$24 | 10.75 |
| Best Kit 1 - Multi-Family | Existing | \$185 | \$37 | 4.96 | \$168 | \$37 | 4.51 | \$168 | \$31 | 5.42 | \$168 | \$204 | 0.82 | \$248 | \$47 | 5.32 |
| 10 W LED | Existing | \$42 | \$16 | 2.61 | \$38 | \$16 | 2.38 | \$38 | \$13 | 2.86 | \$38 | \$82 | 0.46 | \$99 | \$20 | 4.98 |
| 1.5 GPM Kitchen Aerator | Existing | \$11 | \$2 | 6.81 | \$10 | \$2 | 6.19 | \$10 | \$1 | 7.45 | \$10 | \$23 | 0.46 | \$28 | \$2 | 13.36 |
| .5 GPM Bathroom Aerator | Existing | \$28 | \$0 | 63.15 | \$25 | \$0 | 57.41 | \$25 | \$0 | 69.06 | \$25 | \$52 | 0.48 | \$65 | \$1 | 118.37 |
| 1.5 GPM Showerhead | Existing | \$104 | \$19 | 5.41 | \$94 | \$19 | 4.92 | \$94 | \$16 | 5.92 | \$94 | \$210 | 0.45 | \$258 | \$24 | 10.75 |
| Best Kit 1 - Single Family | Existing | \$185 | \$47 | 3.97 | \$168 | \$47 | 3.61 | \$168 | \$31 | 5.42 | \$168 | \$665 | 0.25 | \$823 | \$47 | 17.67 |
| 10 W LED | Existing | \$42 | \$16 | 2.61 | \$38 | \$16 | 2.38 | \$38 | \$11 | 3.34 | \$38 | \$80 | 0.47 | \$97 | \$20 | 4.88 |
| 1.5 GPM Kitchen Aerator | Existing | \$11 | \$2 | 6.81 | \$10 | \$2 | 6.19 | \$10 | \$1 | 8.69 | \$10 | \$23 | 0.46 | \$28 | \$2 | 13.26 |
| .5 GPM Bathroom Aerator | Existing | \$56 | \$1 | 63.15 | \$51 | \$1 | 57.41 | \$51 | \$1 | 80.60 | \$51 | \$104 | 0.48 | \$130 | \$1 | 118.28 |
| 1.5 GPM Showerhead | Existing | \$208 | \$38 | 5.41 | \$189 | \$38 | 4.92 | \$189 | \$27 | 6.91 | \$189 | \$415 | 0.46 | \$511 | \$48 | 10.65 |
| Best Kit 2 - Multi-Family | Existing | \$317 | \$59 | 5.36 | \$288 | \$59 | 4.87 | \$288 | \$41 | 7.10 | \$288 | \$580 | 0.50 | \$715 | \$71 | 10.05 |
| 10 W LED | Existing | \$42 | \$16 | 2.61 | \$38 | \$16 | 2.38 | \$38 | \$11 | 3.34 | \$38 | \$80 | 0.47 | \$97 | \$20 | 4.88 |
| 1.5 GPM Kitchen Aerator | Existing | \$11 | \$2 | 6.81 | \$10 | \$2 | 6.19 | \$10 | \$1 | 8.69 | \$10 | \$23 | 0.46 | \$28 | \$2 | 13.26 |
| .5 GPM Bathroom Aerator | Existing | \$56 | \$1 | 63.15 | \$51 | \$1 | 57.41 | \$51 | \$1 | 80.60 | \$51 | \$104 | 0.48 | \$130 | \$1 | 118.28 |
| 1.5 GPM Showerhead | Existing | \$208 | \$38 | 5.41 | \$189 | \$38 | 4.92 | \$189 | \$27 | 6.91 | \$189 | \$415 | 0.46 | \$511 | \$48 | 10.65 |
| Best Kit 2 - Single Family | Existing | \$317 | \$59 | 5.36 | \$288 | \$59 | 4.87 | \$288 | \$41 | 7.10 | \$288 | \$770 | 0.37 | \$953 | \$71 | 13.39 |
| Energy Savings Kit - LED - Multifamily | Revised | \$34 | \$12 | 2.82 | \$31 | \$12 | 2.56 | \$31 | \$19 | 1.61 | \$31 | \$75 | 0.41 | \$111 | \$20 | 5.58 |
| Energy Savings Kit - LED - Single Family | Revised | \$34 | \$12 | 2.82 | \$31 | \$12 | 2.56 | \$31 | \$19 | 1.61 | \$31 | \$75 | 0.41 | \$111 | \$20 | 5.58 |