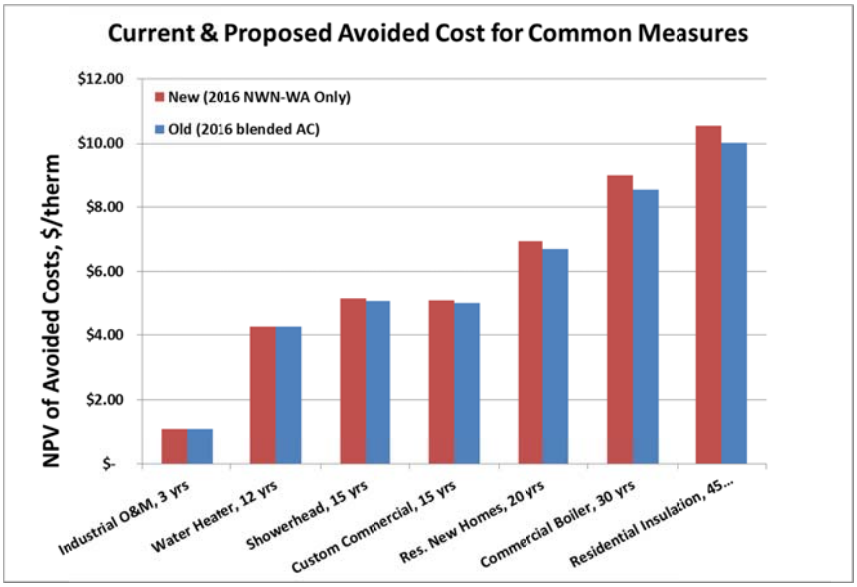
Summary

This memo details an analysis of the cost-effectiveness of Energy Trust energy efficiency measures in Northwest Natural's (NWN) Washington service territory using two different sets of avoided cost (AC) values. Historically, since Energy Trust began delivering energy efficiency programs to NWN's Washington customers, the Washington territory has been considered an extension of the Oregon territory and has been delivered by Energy Trust's existing programs in order to capture and benefit from economies of scale in delivery and outreach and maintain a consistent market structure. Energy

Trust has always used an 'Energy Trust AC', which is a weighted blend of AC values from NWN and the other gas company in our territory, Cascade Natural Gas. We take each company's ACs, weighted average cost of capital, and inflation assumptions, weight these values by % of Revenue (91% NWN, 9% CNG in 2014), then apply the 10% conservation act adder and most recently a premium (hedge) value developed by NWN in May, 2015. ACs provided to us in the past from NWN have been 'system-wide', and have covered both states. Energy Trust uses a discount rate of 4.5%, which is the weighted average of all the investor-owned utilities in Energy Trust's service territory.

Energy Trust most recently updated its blended AC in June, 2015 using the methodology described above. We utilized AC streams from NWN and Cascade Natural Gas's 2014 and 2015 respective IRPs to screen prescriptive and custom measures for the 2016 program year. The base (start) year for NWN's 2014 20-year stream of values was simply moved forward, thus Energy Trust's 2016 blended AC begins using NWN's 2016-year value (and do not use the 2014-15 years) and hold the 18th year constant into the 70th year to cover all potential measure lifetimes. Energy Trust 2016 program planning and measure screening has already been completed with Energy Trust's 'blended' ACs.

Recently, at the request of the Washington Utility and Transportation Commission (WUTC), NWN has developed ACs that are specific to their Washington territory and include a capacity cost value to represent several expected capital-intensive distribution projects that specifically serve the Washington territory and a discount rate of 5.08%. The following analysis reviews the differences and impacts that these Washington-specific ACs have and do not have on the cost effectiveness of Energy Trust's Washington measures and program.



Residential Programs

This section covers the Residential programs of the Washington territory, which includes the Existing Homes, New Homes and Products programs.

Residential: UCT

After running the measures through our cost effectiveness tool with each set of AC values, the 'blended' and the 'Washington-specific', we found the impact to ACs on a per measure basis ranging between 0% and 5.5% for Residential measures. The three key drivers of this range of values are the measure life, discount rate and the load profile of the particular measure, though the measure life has the most significant impact. The Washington-specific AC 20-year stream of values is lower in the early years than the 'blended' values, but higher in the later years. This results in measures with a short life being minimally impacted while measures with longer lives are impacted by the higher values in the out years.

Table 1 below shows the range of % change to AC encountered in the residential measure mix. Because there are a limited number of load profile and measure life combinations, there are a limited number of % changes to the AC, and Table 1 shows these % changes and the number of measures affected. It also shows the % of the total number of measures impacted. Something to bear in mind is that because AC is the only assumption on the Benefit side of the UCT ratio, the % change to AC and the measure's UCT score are identical. The distribution of this impact is shown in Table 1.

Table 1. Showing the range of % change to AC and UCT. Includes # and % of measures impacted.

% Change AC/UCT	# of affected measures	% of Total
0.0%	4	11%
0.7%	1	3%
1.2%	1	3%
1.7%	8	22%
3.0%	1	3%
3.7%	7	19%
4.6%	4	11%
5.1%	1	3%
5.3%	6	16%
5.4%	2	5%
5.5%	2	5%
Total	**37 measures**	**100%**

Table 1 shows that 14% of residential measures have less than a 1% change to their AC and UCT score, 42% have a 3% or less impact and 29% have a >5% change to their AC and UCT score with a maximum impact of 5.5%. No planned measures move above or below the 1.0 UCT threshold due to AC changes.

Table 2 below shows the ten measures with the lowest UCT scores in the 2016 EE mix. It shows the program, measures description, the UCT BCR using the 'WA-only' AC, and the % change in AC and UCT that the measure experienced when switching from Energy Trust's 'Blended' AC. Only one of these

measures contributed a significant level (>1%) of savings in 2014 (most recent year with a full year of data) and a few that are new for 2016 and without an equivalent in 2014 are named 'New'.

Table 2. Ten measures with lowest UCT Scores in 2016 mix. Showing % change in UCT from ETO Blended AC to WA-Only AC and the % of 2014 Savings these measures contributed.

Program	Measure Description	UCT BCR (WA-Only AC)	% change in UCT	% of 2014 Savings
Existing Homes	Water Heater, Gas .67-.69 $100 2016	0.98	0.0%	New
Existing Homes	Water Heater, Gas .67-.69 $125 2014	0.99	0.0%	0.5%
Existing Homes	Water Heater, Gas .70 $125, 2016	1.06	0.0%	0.2%
Existing Homes	SF Air Sealing, $150 Gas 2013	1.19	3.7%	0.2%
Existing Homes	Windows - GAS - U .28-.30	1.21	5.3%	4.0%
Existing Homes	Windows - GAS - U <=.27	1.27	5.3%	0.6%
Existing Homes	SF Duct Insulation, Gas Heat	1.30	5.3%	0.1%
Existing Homes	Showerhead Themostatic Restriction Valve, Gas	1.38	0.0%	New
Existing Homes	SF Floor Insulation/SQFT, Gas Heat, Zone 1 2014	1.41	5.3%	0.6%
Existing Homes	SF Knee Wall Insulation/SQFT, Gas Heat, Zone 1 2014	1.77	5.3%	0.1%

Two measures score slightly below the 1.0 threshold when showed to the hundredth digit (Energy Trust reports to the 'tenth' digit, at which point these measure round to 1.0), a 2014-15 legacy 0.67-0.69 gas tank water heater measure, which scores a 0.98 and the new 2016 0.67-0.69 measure, which scores a 0.99. There was a 0.01% impact to these measure's AC, which did not have a material impact on the UCT.

Residential: TRC

The impact to TRC on a per measure basis ranges between 0% and 5.3%. Unlike the UCT, the impact to AC and the TRC score differ in a number of measures because of the presence of NEBs on the benefit side of the ratio. Though similar to Table 1, Table 3 below shows the distribution of % change encountered when applying the Washington-only AC.

Table 3. Showing the range of % change to TRC BCR. Includes # and % of measures impacted.

% Change TRC	# of affected measures	% of Total
0.0%	4	11%
0.1%	1	3%
0.3%	4	11%
0.4%	4	11%
0.7%	1	3%
3.0%	1	3%
3.7%	7	19%
3.9%	1	3%

4.3%	1	3%
4.4%	2	5%
4.5%	1	3%
4.6%	3	8%
4.8%	1	3%
5.3%	6	16%
Grand Total	**37**	**100%**

Table 3 shows that 39% of all residential measures were impacted by a < 1% change when the Washington-specific AC is applied. The remaining 61% are impacted by >3% but no more than 5.3%.

Table 4 below shows the ten Residential measures with the lowest TRC scores in the 2016 EE measure mix. It shows the TRC score with the 'WA-only' AC, the % change the TRC scorer shifted when switching from the Energy Trust 'blended AC' to the 'WA-only' AC. Only two of these measures contributed a significant level (>1%) of savings in 2014 (most recent year with a full year of data) and a few that are new for 2016 and without an equivalent in 2014 are named 'New'.

Table 4. Ten measures with lowest TRC Scores in 2016 mix. Showing % change in TRC from ETO Blended AC to WA-Only AC and % savings contributed to Sector in 2014

Program Code	Measure Description	TRC BCR (WA-Only AC)	% change in TRC	% of 2014 Savings
Existing Homes	SF Floor Insulation/SQFT, Gas Heat, Zone 1 2014	0.26	5.3%	0.1%
Existing Homes	Water Heater, Gas .70 $125, 2016	0.31	0.0%	0.2%
Existing Homes	SF Gas Boiler	0.32	4.6%	.05%
New Homes	SW WA EPS Path 5	0.36	4.5%	New
New Homes	SW WA EPS Path 4	0.37	4.4%	New
New Homes	SW WA Energy Star New Homes - 2015	0.37	4.3%	8.7%
Existing Homes	SF Knee Wall Insulation/SQFT, Gas Heat, Zone 1 2014	0.38	5.3%	.05%
Existing Homes	Water Heater, Gas .67-.69 $100 2016	0.49	0.0%	New
Existing Homes	Water Heater, Gas .67-.69 $125 2014	0.62	0.0%	0.5%
Existing Homes	SF Attic Insulation/SQFT, Gas Heat, Zone 1 2014	0.66	5.3%	1.4%

There are 14 measures in the Residential portfolio that have a TRC score of less than 1.0. All but 2 of these have scores below 0.9 and a change in AC did not move them into a more or less cost-effective range. One measure, the 90-94%+ AFUE gas furnace did however move 4.6% from a TRC score of 0.92 with Energy Trust Blended ACs to a 0.97 with Washington-specific ACs. This is a legacy measure from 2014 though, and will only be used in the first 90 days of 2016 to meet customer expectations and cover the transition to the new 95%+ AFUE measure created for 2016. The new 95%+ measure's approval as an offering in the program is did not make this list and is not significantly affected by the increase in AC.

The other >.9 TRC measure affected is the EPS Path 2 offering in the New Homes program. Its TRC score bumps 4.8% from a 0.9 to a 0.94 TRC. This still falls below the 1.0 threshold and its approval as an offering is unaffected by the increase in AC value.

Potential Residential Program Impact

Evaluation of the impacts of using the Washington specific Avoided cost on "top ten measures with lowest UCT score", and the "Ten measures with lowest TRC Scores in 2016 mix" has showed little to no impact on the cost effectiveness of the measure. The evaluation has also determined that no significant additional measures could be added to the Program portfolio. Similarly the resulting data shows that no measures are at risk of being lost due to falling below the cost effectiveness screening threshold of 1.0 using the UCT. The results of this analysis can also be used to determine the effect of Washington specific AC on the max allowable incentive per measure. With such a small impact on the cost effectiveness per measure, the impact on max allowable incentive is also small. Based on deemed savings per measure and the forecasted quantity of each measure realized, the Program has projected that proposed incentives would not be altered as to ensure the overall program cost effectiveness.

Commercial Program

This section covers the Commercial Sector of the Washington territory, which includes the Existing Buildings Program. This section primarily discusses 'Prescriptive' measures, which are screened for cost effectiveness in advance of the program year. Custom measures, which are screened for cost-effectiveness on an individual project basis, are discussed separately after the prescriptive measures.

Commercial: UCT

After running the measures through our cost effectiveness tool with each set of AC values, the 'blended' and the 'Washington-specific', we found the impact to ACs on a per measure basis ranging between -1.7% (negative) and 5.4%. Because AC is the only assumption on the Benefit side of the UCT ratio, the % change to AC and the UCT score are identical. The range and distribution of these % changes when moving from one AC to the other is shown in Table 5 below. As discussed in the beginning of the Residential Sector, the % change was most impacted by the number of years the measure life is rated to last. Thus, due to the differences in the 20-year stream of ACs in the two sets, measures with a short lifetime in the Existing Buildings Program actually decreased in value with the Washington-specific AC and increased for longer-lived measures.

Table 5. Showing the range of % change to AC and UCT. Includes # and % of measures impacted.

% Change of AC/UCT	# of affected measures	% of Total
-1.7%	1	2%
-1.6%	1	2%
-1.5%	14	26%
0.0%	8	15%
1.7%	12	23%
3.0%	4	8%
3.7%	5	9%
5.4%	8	15%
Total	53	100%

Table 5 shows that 30% of Commercial Sector measures had their AC value decrease by about 1.5% while 15% had no change in value. 32% of measures increased by 3% to 5.4%.

Table 6 below shows the 10 measures in the Existing Buildings Program with the lowest UCT BCR scores. It also shows the % change that occurred to that UCT score when the Washington-only AC were applied. Only a few of these measures contributed a savings in 2014 (most recent year with a full year of data) and those that went unused or did not exist are labeled N/A.

Table 6. Ten measures with lowest UCT Scores in 2016 mix. Showing % change in UCT from ETO Blended AC to WA-Only AC and % of savings contributed in 2014.

Program	Measure Description	UCT BCR (WA-Only AC)	% change in UCT	% of 2014 Savings
Existing Buildings	Dishwasher - Under counter - gas high temp	0.89	-1.5%	N/A
Existing Buildings	Steam Traps -Effective January 1, 2016 Schools Only.	0.98	-1.5%	New
Existing Buildings	Commercial Clothes Washer-Gas Water Heat	1.02	-1.5%	N/A
Existing Buildings	Infrared (IR) polyethylene greenhouse cover	1.12	-1.6%	N/A
Existing Buildings	Boiler Vent Damper	1.22	0.0%	N/A
Existing Buildings	Gas Griddle	1.24	0.0%	N/A
Existing Buildings	Roof Insulation R-5 to R-20 gas heat	1.35	5.4%	3.3%
Existing Buildings	Attic Insulation R-19 to R-38 gas heat	1.42	5.4%	0.5%
Existing Buildings	Domestic Tankless Water Heaters - Food service	1.45	1.7%	N/A
Existing Buildings	Gas Combination Ovens	1.63	0.0%	1.0%

No planned measures move above or below the 1.0 UCT threshold due to changes in the value of AC. The dishwasher measure moved from a 0.90 to a 0.89 with the Washington-only AC. This measure appears to have escaped updating by our engineering team over the last year or two, likely due to its low priority/uptake (No uptake in 2014-2015). Occasionally, measures remain slightly below their cost-effective threshold until they are reviewed the following year. This measure is being discussed by the program right now and the incentive may be lowered or kept the same depending on a range of factors, such as the stage of development of marketing materials. Either way, the AC did not have a material impact on the measure's current status. The steam trap measure for schools scores below the 1.0 threshold when showed to the hundredth digit (Energy Trust reports to the 'tenth' digit, at which point these measure round to 1.0) and would not be altered due to using either AC value.

Commercial: TRC

The impact to TRC on a per measure basis ranges between -1.6% and 5.4%. The impact to AC and the TRC score differ in some measures because of the presence of NEBs on the benefit side of the ratio. The distribution of this impact is shown in Table 7. In the case of this measure mix, some measures decrease in value due to the lower avoided cost values in the first years of the Washington-only AC compared to the Energy Trust 'Blended AC'.

Table 7. Showing the range of % change to TRC BCR. Includes # and % of measures impacted.

% Change of TRC	# of affected measures	% of Total
-1.6%	1	2%
-1.5%	4	8%
-0.9%	1	2%
-0.3%	1	2%
-0.2%	6	11%
-0.1%	2	4%
0.0%	8	15%
1.1%	2	4%
1.7%	11	21%
2.3%	2	4%
3.0%	4	8%
3.7%	3	6%
5.4%	8	15%
Total	53	100%

Table 7 shows that 29% of Commercial Sector measures will have a decrease in AC value, while 15% had no change in value. 29% of measures increased by 3% to 5.4%.

Table 8 below shows the 10 measures with the lowest TRC scores in 2016 and the % change in TRC when the Washington-only AC were applied. None of these measures contributed a significant (>1%) share of savings in 2014 (most recent year with a full year of data) and most went unused in 2014.

Table 8. Ten measures with lowest TRC Scores in 2016 mix. Showing % change in TRC from ETO Blended AC to WA-Only AC

2015 Measure Code	Measure Description	TRC BCR (WA-Only AC)	% change in TRC	% of 2014 Savings
Existing Buildings	Gas Griddle	0.42	0.0%	N/A
Existing Buildings	Attic Insulation R-19 to R-38 gas heat	0.50	5.4%	0.5%
Existing Buildings	Domestic Tankless Water Heaters - Food service	0.73	1.7%	N/A
Existing Buildings	Boiler Vent Damper	0.81	0.0%	N/A
Existing Buildings	Warm-Air Furnace < 225 kBtuh input	0.95	3.0%	N/A
Existing Buildings	Turbo Pot with Lid	0.95	-1.5%	N/A
Existing Buildings	Wall Insulation - Gas heating	1.02	5.4%	N/A
Existing Buildings	Domestic Tankless Water Heaters - Lodging	1.13	1.7%	N/A
Existing Buildings	Pipe Insulation - Hot water - Pipe Diameter > 1.5"	1.18	1.7%	N/A
Existing Buildings	Pipe Insulation - Hot water - Pipe Diameter ≤ 1.5"	1.18	1.7%	N/A

There are 7 measures that have a TRC score of less than 1.0. Of the 7 measures, 4 of these have scores below 0.9. Three measures have a TRC of greater than 0.9 and were impacted somewhat by AC. The Turbopot measure lands at a 0.97 TRC with Energy Trust's blended AC and decreases slightly to 0.95 with the WA-only AC.

Wall insulation has been given a new incentive to match Oregon's incentive to help maintain market consistency and its TRC now falls to 0.97 with Energy Trusts blended AC. With Washington-only AC this value increases 5.4% to 1.02. The Warm-Air Furnace measure remains unchanged from 2015, and scores a TRC of 0.92 with Energy Trust's Blended Avoided costs. With Washington-only AC this value increases 3% to 0.95. In each of these cases however, a change in AC did not impact their availability or the incentive amount that the program offered.

Commercial: Custom Measures

Because custom measures are vetted for cost effectiveness on a project by project basis prior to their approval, it is unlikely for minor changes in AC to have a significant impact on their acquisition. In 2014 (the last year that we have a complete year's data) 12 of 15 of the custom projects had measure lives of 15 years and had a change in AC of 1.7%. Two measures with a 20-year measure life changed by 3.7% and one measure with a 10-year measure life decreased by -1.6%.

There were no custom projects with a UCT BCR of less than 2.0 and the average UCT across all the projects was 4.27 (using WA-only AC). On the TRC side, 13 of the 15 total projects had individual TRC scores well over a 1.0 and the average across all projects was 3.65. Two projects had scores below 1.0, a 0.88 and 0.42. These projects share a project ID number with other measures and may have been screened together at the time the project was vetted. In any event, the change in AC that would occur by using a Washington-only value would not have a significant impact and it is unlikely that the number of custom measures would be impacted with a change in AC. Table 9 below shows a breakdown of custom measures with the average % change in AC and the average WA-only UCT and TRC scores. It also shows the % of savings that the given measure group was responsible for in the Commercial Sector in 2014 (last year of complete data).

Table 9. Custom measure groups showing project quantity, BCRs and average % change in AC

Custom Measure Group	Quantity	Average % change in AC	Average UCT (WA-only AC)	Average TRC (WA-only AC)	% of 2014 Savings
Custom Building Controls	5	1.1%	2.82	5.49	23%
Custom Gas	4	1.7%	4.79	24.80	2%
Custom Heat Recovery	1	3.7%	3.74	1.87	8%
Custom HVAC	4	2.2%	3.43	1.97	2%
Custom VFD	1	1.7%	N/A	6.53	11%

The tables below provide some insight into the highest-savings measures in each Sector, showing the % of savings they contributed to their respective Sector in 2014, the % change in AC they are impacted by when changing to Washington-only AC, and their UCT and TRC scores. In the case of the Custom VFD measure, there was only one measure and no incentive was paid for the project, resulting in the N/A for the UCT.

Table 10. Top 4 Savings Measures in the Commercial Sector with their % of 2014 Savings, % change in AC and Average UCT and TRC scores with Washington-only ACs.

Program	Measure Group	Measure Description	% of 2014 Savings	Average % change in AC	Average UCT (WA-only AC)	Average TRC (WA-only AC)
Existing Buildings	Custom Building Controls	Custom Building Controls	23%	1.1%	2.82	5.49
Existing Buildings	Food Equipment	Gas Fryer 2014	20%	0.0%	3.0	2.14
Existing Buildings	Boiler	Gas-fired Condensing Boiler >= 300 kbtuh, <= 2500 kbtuh 0.9 ET	15%	5.4%	3.42	2.11
Existing Buildings	Custom VFD	Custom VFDs	11%	1.7%	N/A	6.53

Table 11. Top 4 Savings measures in the Residential Sector with their % of 2014 Savings, % change in AC and UCT and TRC scores with Washington-only ACs.

Program	Measure Group	Measure Description	% of 2014 Savings	% change in AC	UCT (WA-only AC)	TRC (WA-only AC)
Products	Showerhead	NWNWA 2.0 gpm Showerhead	14%	1.73%	5.60	22.18
Existing Homes	Gas Fireplace	Gas Hearth .70+ FE with Intermittent Pilot Light	9%	3.66%	2.97	743.22
New Homes	Builder Option Package	SW WA Energy Star New Homes - 2014 ONLY	9%	5.12%	1.95	0.37
Existing Homes	Gas Furnace	Gas Furnace $100 Incentive	7%	4.64%	3.21	0.68

Potential Commercial Program Impact

Evaluation of the impacts of using the Washington specific Avoided cost on “top ten measures with lowest UCT score”, and the “Ten measures with lowest TRC Scores in 2016 mix” has showed little to no impact on the cost effectiveness of the measure. The evaluation has also determined that no significant additional measures could be added to the Program portfolio. Similarly the resulting data shows that no measures are at risk of being lost due to falling below the cost effectiveness screening threshold of 1.0 using the UCT. The results of this analysis can also be used to determine the effect of Washington specific AC on the max allowable incentive per measure. With such a small impact on the cost effectiveness per measure, the impact on max allowable incentive is also small. Based on deemed savings per measure and the forecasted quantity of each measure realized, the Program has projected that proposed incentives would not be altered as to ensure the overall program cost effectiveness. This is also in part due to the Programs measure design for 2016 whereby incentives have been set at levels that are already near the max allowed amount. The Washington specific avoided costs as applied to the commercial portfolio help to ensure the portfolio will meet cost effective delivery goals for 2016.