

Energy Trust Electric and Gas Avoided Cost Update for Oregon for 2018 Measure and Program Planning

August 8, 2017

Energy Trust's estimates of future electric and gas avoided costs are critical assumptions used to value energy savings from efficiency measures and programs. Avoided costs are the primary component of the value of energy savings used in the numerator in the Total Resource Cost (TRC) and Utility Cost Test (UCT) benefit/cost ratios used by Energy Trust for cost-effectiveness screening. Energy Trust estimates future avoided costs primarily based on forecasts developed by utilities, combined and adapted to be suitable for assessing efficiency cost-effectiveness.

Consistent with Energy Trust's agreement with the Oregon Public Utility Commission (OPUC) staff, Energy Trust is updating electric and gas avoided costs for Oregon in 2017 for use in 2018 program and measure planning. As part of the update, Energy Trust hosted separate electric and gas meetings to engage the stakeholder community regarding Energy Trust's methodology, the avoided cost inputs, and proposed changes for 2018.

Subsequent to the stakeholder meetings, Energy Trust engaged: 1) OPUC staff on electric and gas avoided cost updates; 2) PGE and Pacific Power separately on electric avoided cost updates; and 3) NW Natural, Cascade Natural Gas and Avista Natural Gas separately on gas avoided cost updates. This memo outlines the updates that Energy Trust is making to electric and gas avoided costs and the next steps to continue additional process improvement moving forward.

Electric Avoided Cost Updates

Proposed and Adopted Changes

As part of the stakeholder meetings and follow-up conversations with the PUC and stakeholders, Energy Trust incorporated the following four changes into this electric avoided cost update:

1. Incorporated as many years of price forecasts that utilities had available¹.
2. Calculated avoided cost values for every year as opposed to interpolating values between 10-year periods.
3. Applied 10% conservation adder to transmission and distribution (T&D) and generation capacity deferral values consistent with the Northwest Power and Conservation Council (NWPCC)².
4. Applied T&D line losses to the generation capacity deferral credit to reflect savings at the generator consistent with the NWPCC.

¹ We had previously used 20 years of utility forecasts, but had discovered that a longer forecast is available in some cases.

² This is in addition to applying it to the fuel price forecasts as had been done for previous estimates.

Additional changes that were considered for this update but were not adopted because they require additional analysis and conversations with stakeholders:

1. Assigning generation capacity deferral value according to the coincidence of each load shape with the NWPCC regional peak³, as opposed to applying the value evenly over all load shapes. This would be consistent with how Energy Trust currently applies the T&D deferral value.
2. Using utility-specific peak periods to calculate T&D and generation capacity deferral values as opposed to the NWPCC regional peak period.
3. Including generation capacity deferral value starting in the first year of the analysis period for both utilities regardless of sufficiency period.
4. Applying 10% conservation adder to risk reduction value.
5. PGE proposed an RPS deferral value.

During the update process it became clear that the values the electric utilities provided for forecasted avoided costs have shifted relative to previous years such that: a) energy price forecasts have decreased; and b) the generation capacity deferral value has increased. As a result, the generation capacity deferral value makes up a greater proportion of the overall avoided cost value than in previous sets of avoided costs.

This change is not specific to the two electric utilities whose customers Energy Trust serves; in the 7th Power Plan, the NWPCC found the need to focus more explicitly on generation deferral value⁴, noting that capacity is becoming more important to the region compared to years past.

In recognition of the growing importance of capacity, Energy Trust attempted to refine its current methodology to more accurately assign the generation deferral value by load shape, as opposed to using a single value for all load shapes (#1 from additional changes considered above). However, the following complications prevented Energy Trust from adopting this change in the current update to avoided costs:

1. The method for allocating the generation capacity deferral value appropriately between summer and winter peak for dual-peaking utilities is still under development.
2. Energy Trust's current savings estimates for many measures and its screening tool are not designed to address both summer and winter savings for weather-dependent measures
3. Energy Trust needs to review the NWPCC's 7th Plan load profiles to assure that summer peak savings are reasonably reflected in load shapes. Because the region is winter peaking, this has not been a high priority issue for NWPCC staff.

As these complications emerged, it became clear that they also apply to the method used to value T&D capacity deferral. For this avoided cost update, Energy Trust will continue to use the existing methods to value T&D capacity deferral and generation capacity deferral as defined in the respective sections below. The existing methods are appropriate for the time being because they assign some value to capacity deferral and they have been previously approved by OPUC staff.

Moving forward, resolving the new and complex issues related to peak demand reductions from energy efficiency is important for Energy Trust and the region. Any proposed methodological changes to quantify and value peak demand reductions, specifically summer peak demand reductions, require more extensive examination and development by regional stakeholders.

³ The NWPCC regional peak hour is modeled as 6:00 pm on a winter weekday (December through February).

Source: <https://nwcouncil.app.box.com/s/gacr21z8i89hh8ppk11rdzgm6fz4xlz3>

⁴ In the 6th Power Plan, the generation capacity credit was modeled as a bundled value along with the risk reduction credit and other adders. When developing the 7th Plan, the NWPCC broke out the value separately, recognizing the growing importance of this value in the avoided cost buildup. The NWPCC shared that they find the generation credit to be about two to three times the T&D credit in terms of \$/kW-yr.

Energy Trust expects to collaborate with regional stakeholders to develop a suitable method to employ in future avoided cost updates.

Other proposed changes not adopted in this update may be revisited in the future.

Final Methodology for Electric Avoided Cost Update

The final methodology for electric avoided costs for 2018 consists of five key components.

1. Energy price forecasts
2. Avoided T&D capacity deferral value
3. Avoided generation capacity deferral value
4. Regional 10% conservation credit
5. Risk reduction value

The basic formula to calculate electric avoided costs follows:

Electric Avoided Cost =

$$\begin{aligned} & \text{Energy price forecast} \times (1+10\% \text{ Power Act Credit}) \times (1 + \text{marginal line losses}) \\ & + \text{T&D deferral value} \times (1+10\% \text{ Power Act Credit}) \times (1 + \text{marginal line losses}) \\ & + \text{Generation deferral value} \times (1+10\% \text{ Power Act Credit}) \times (1 + \text{marginal line losses}) \\ & + \text{Risk Reduction Value} \end{aligned}$$

The above calculation is performed for each NWPCC load shape Energy Trust uses. The resulting avoided cost values are converted to net present value based on measure life and the resulting value is applied to the estimated electric savings achieved at the site. The elements of the formula that rely on NWPCC load shape information are the energy price forecast and the T&D capacity deferral value. The subsections below describe in more detail the basic components of the formula and any additional calculations or weighting that is applied.

Energy Trust blends all avoided cost inputs for the elements described below based on the 2017 revenue split between PGE (63%) and Pacific Power (37%). The marginal line loss calculation follows the Regional Technical Forum (RTF) methodology, which is a regionally accepted method applied to the utility-provided line loss estimates for both transmission and distribution.

Energy Price Forecast

PGE and Pacific Power provided Energy Trust with current versions of energy price forecasts for both high- and low-load hours (on- and off-peak, respectively). These prices include assumptions from each utility about the cost of compliance with potential future carbon policies. A weighted average blend of each utility's forecast for on- and off-peak prices is then calculated in \$/MWh for each month of each year. These weighted monthly price streams for on- and off-peak hours are then multiplied by the percent of time a given load shape is on- and off-peak within the month, based on the 2x12 matrix⁵ of peak usage used by the NWPCC in the 7th Plan.

The resultant monthly prices are summed for each year and adjusted by adding marginal transmission and distribution line losses to reflect savings at the generator. Finally, these values are converted to \$/kWh saved at a customer's site.

Avoided T&D

Energy Trust received separate transmission and distribution capacity deferral values from each utility in \$/kW-year, as has been past practice. The two deferral credits are blended together

⁵ The 2x12 matrix captures the percent of usage falling on- and off-peak (the "2") for each month (the "12").

according to the 2017 revenue split. The 2018 distribution credit is \$25.35/kW-yr for PGE and \$7.79/kW-yr for Pacific Power⁶. The 2018 transmission credit is \$8.59/kW-yr for PGE and \$6.07/kW-yr for Pacific Power.

The blended transmission capacity deferral value is modified for each load profile from the 7th Plan used by Energy Trust. The calculation translates the \$/kW-yr provided by the utilities into \$/kWh used in the avoided costs based on the amount of energy that profile indicates is consumed during the NWPCC's regional peak hour, relative to an average annual kWh. This value is adjusted by adding marginal transmission and distribution line losses to reflect savings at the generator.

The blended distribution capacity deferral value is modified in the same fashion for each load profile from the 7th Plan used by Energy Trust. This value is adjusted by marginal distribution losses to reflect the savings that occur at the distribution level.

Through discussions with PGE and Pacific Power, it was determined that PGE has a dual summer and winter peak and Pacific Power is summer peaking. This emphasizes the need to move away from valuing T&D deferral during the NWPCC's regional peak period in the future. Given the complications described above, Energy Trust opted to retain the current methodology and revisit the issue in a future avoided cost update.

Generation Capacity Deferral Value

The generation capacity deferral value was supplied to Energy Trust in an average \$/MWh format, consistent with past practice. This means the value is applied evenly across load profiles (i.e. there is no shaping to reflect different peak contributions). The timing and value of this benefit varies by utility system. Pacific Power's resource deficiency period begins in 2021 with a value of \$16.08/MWh leveled⁷. PGE first assigns value to generation capacity deferral to 2018 at \$14.34/MWh leveled.

Energy Trust took these inputs and calculated a blended Generation Capacity Deferral value in \$/kWh. This value is adjusted by adding marginal transmission and distribution line losses to reflect savings at the generator.

Through discussions with PGE and Pacific Power, it was determined that PGE has a dual summer and winter peak and Pacific Power is summer peaking. This emphasizes the need to apply end use specific load shapes to value generation deferral in accordance with the utilities' defined peaks. However, given the complications described above, Energy Trust opted to retain the current methodology and revisit the issue in a future avoided cost update.

10% Power Act Credit

The Northwest Power Act directs the NWPCC and Bonneville to give conservation a 10 percent cost advantage over sources of electric generation. The Council does this by calculating the credit as 10 percent of the value of energy saved at wholesale market prices, plus 10 percent of the risk reduction value, plus ten percent of the value of savings from deferring electric generation, transmission, and distribution system expansion.

Energy Trust follows this practice and adds 10 percent to all avoided cost components except risk reduction values. During this update, the question of whether the risk reduction values are

⁶ All values provided by utilities were converted to 2018 dollars where necessary based on each utility's assumed inflation rate. We converted to 2018 dollars because this is the first year where the avoided costs will be applied.

⁷ Pacific Power initially submitted a generation capacity deferral value with a resource deficiency period that began in 2028 to reflect the addition of a thermal generation resource and later updated the period to begin in 2021 to reflect the addition of a wind generation resource.

captured within the 10 percent credit was discussed. One question is whether it is duplicative to include both in the calculation. Stakeholders agreed to continue to include both values in the avoided costs but not to apply the 10% credit to the risk reduction value.

Risk Reduction Value

In addition to avoided T&D and generation capacity investments, both utilities quantified the value of fuel price risk avoidance. Pacific Power's IRP refers to this as stochastic risk reduction with an average value across efficiency savings shapes of \$1.46/MWh leveled. PGE's risk reduction value is \$5.08/MWh leveled. These values were blended.

Electric Avoided Cost Results and Comparison

Compared to the current avoided costs, the new avoided costs are lower, but the decrease varies across measure savings, shapes and lifetimes. For example, avoided costs for residential ductless heat pumps (18-year measure life) declined 6%, while avoided costs for commercial interior lighting (15-year measure life) declined 14%. The difference illustrates the importance of load shape and measure life in determining value. Table 1 below compares the new and previous avoided costs for the most commonly used load profiles based on 2016 electric measure savings⁸.

Table 1. Net Present Value per first year kWh

Sector	Load Profile	Measure Life	2016 Claimed Savings	Old 2016 Blended AC \$/kWh	New 2018 Blended AC \$/kWh	% change from old (2016 AC) to new (2018 AC)
COM	Other Interior lights	15	31,031,928	\$0.85	\$0.73	-14%
COM	Large Office Heat	18	13,678,315	\$1.02	\$0.90	-12%
COM	Grocery Refrigeration	11	9,770,221	\$0.60	\$0.53	-12%
COM	Large Office Heat - SEM	5	10,815,180	\$0.30	\$0.25	-18%
IND	Flat	14	36,588,395	\$0.71	\$0.65	-9%
IND	3-Shift Industrial	13	34,374,265	\$0.69	\$0.61	-12%
IND	Flat - SEM	5	8,330,453	\$0.25	\$0.22	-12%
RES	Res Lighting	12	111,952,481	\$0.73	\$0.63	-14%
RES	Res Water Heat	16	24,604,655	\$0.93	\$0.78	-16%
RES	Res Air Source HP	18	7,034,247	\$1.11	\$0.95	-14%
RES	Res Ductless HP	18	4,856,814	\$1.03	\$0.98	-6%
RES	Res HP Water Heat (13 yr)	13	770,276	\$0.80	\$0.66	-18%

⁸ These adjusted values do not incorporate any changes to cost or savings analysis from the ongoing process to review measures for 2018. They also do not include non-energy benefits. They solely illustrate the impact of the changes in avoided cost.

Gas Avoided Cost Updates

As part of the stakeholder meetings and follow-up conversations with the PUC and stakeholders, Energy Trust incorporated the following changes into this gas avoided cost update:

1. Incorporated as many years of gas price forecasts that utilities have available.
2. Made improvements to the method for how avoided costs between 10-year periods are being calculated.
3. Incorporated a state CO₂ policy adder for each utility.
4. Incorporated supply and distribution capacity costs for utilities that have calculated these values based on peak-day savings by load shape. The 10% conservation adder is applied to these costs.

The agreed upon methodology for gas avoided costs consists of five key components. Those components are:

1. Gas Price Forecasts
2. Supply and Distribution Capacity Costs
3. Oregon State Carbon Policy Adder
4. Risk Reduction Value
5. 10% Power Act Credit

The formula to calculate Gas Avoided Costs follows:

Gas Avoided Cost =

$$\begin{aligned} & \text{Gas Price Forecast} \times (1+10\% \text{ Power Act Credit}) \\ & + \text{Supply and Distribution Capacity Value} \times (1+10\% \text{ Power Act Credit}) \\ & + \text{State Carbon Policy Adder} \times (1+10\% \text{ Power Act Credit}) \\ & + \text{Risk Reduction Value} \end{aligned}$$

The net present value of gas avoided costs are calculated using the above component parts for first year savings using load shapes from the NWPCC's 7th Power Plan. Even though NWPCC's load shapes were developed for electric savings measures, the usage profiles are useful proxies and representative for gas savings measures as well; the rationale being that customers are using energy for some end uses at the same time despite whether the fuel being used is gas or electricity. Energy Trust uses a select list of NWPCC load profiles to represent the monthly usage for gas. These include:

- Residential Space Heating
- Commercial Space Heating
- Domestic Hot Water
- Flat throughout the year
- Clothes washer:

The above calculation is performed for each of the load shapes Energy Trust uses for gas. The resulting avoided cost values are converted to net present value based on measure life and the resulting value is applied to the gas savings achieved at the site. The energy price forecast and the Supply and Distribution Capacity Value rely on load shape and peak day/annual load information. The subsections below describe in more detail the basic components of the formula and any additional calculations or weighting that is applied.

Energy Trust blends avoided cost inputs for the elements described below based on the 2017 revenue split between NW Natural (86%), Cascade Natural Gas (11%) and Avista (4%)⁹.

⁹ Values do not add up to 100% due to rounding.

Gas Price Forecasts

Energy Trust received the most recent gas price forecasts available from NW Natural Cascade Natural Gas and Avista. A weighted average blend of forward market prices was calculated in 2018 \$/therm for each year. These values are then adjusted to reflect monthly variation in price and relative consumption across the year. Monthly price variation information was sourced from the NWPCC and NW Natural. Energy Trust used NWPCC price variation data for Cascade Natural Gas and NW Natural price variation data for NW Natural and Avista per direction from Cascade Natural Gas and Avista respectively.

Supply and Distribution Capacity Cost

For their 2016 IRP, NW Natural developed annual per therm values for Supply and Distribution Capacity Costs. Energy Trust incorporated these values into this update for gas avoided costs. The NW Natural values were blended with zero values for the other two utilities since at this time they have not yet developed these figures. Finally, these values are multiplied by the following peak day/annual load factors. These values indicate the percent of annual savings expected to occur on a peak day:

Load Shape	Peak Day Factor	Source
Residential Space Heating	2.1%	NW Natural
Commercial Space Heating	1.8%	NW Natural
Domestic Hot Water	0.4%	NWPCC
Flat	0.3%	NWPCC
Clotheswasher	0.2%	NWPCC

State Carbon Policy Adders

For this update all three gas utilities provided values that reflect anticipated future costs associated with possible state carbon policies. These values were blended. Descriptions of how these values were calculated for each utility follow:

NW Natural developed a projection of expected costs of complying with state carbon policies separate from the impact of policy on the broader natural gas market included in the natural gas price forecast provided by its 3rd party consultant per Oregon PUC IRP guidelines. While NW Natural currently has no state carbon cost compliance obligation it was determined that carbon compliance costs are likely in Oregon over the IRP planning horizon. Since the outcome of prospective policy is highly uncertain, NW Natural included a number of state carbon policy scenarios in its IRP, inclusive of its avoided costs. The base case state carbon policy adder used in NW Natural's avoided costs provided to Energy Trust is based upon a delayed forecast of the price of carbon allowances in California's cap and trade program from the Northwest Power and Conservation Council (NWPCC). Given that California has an existing carbon cap and trade system the stream of prices forecasted by the NWPCC for California is delayed with the 2016 price for California used as the projected 2021 cost of compliance in Oregon (and the 2018 California price used as the 2022 price in Oregon and so on- i.e. prices are delayed by 5 years).

Cascade Natural Gas evaluates the impact that a range of environmental externalities, including CO2 emissions prices, would have on avoided costs in terms of cost adders and supply costs. The company developed its carbon policy adder by multiplying its price forecast by 10% to factor for environmental externalities. This is consistent with the recommendations of the Northwest Power and Conservation Council. After the 10% multiplier is added, Cascade then

converts the \$10/ton carbon tax into a dollar value per MMBtu. This is then added into the commodity cost.

Avista models carbon as an incremental price adder to address any potential policy. Carbon adders increase the price of a dekatherm of natural gas and can impact resource selections and demand through expected elasticity. The starting price was assumed to be similar to California's cap and trade system where the initial floor was set at \$10 per metric ton of CO₂. The remaining distribution was equally divided into the likelihood between the high case, Washington State's I-732, and the low case of no carbon adder. The final, Expected Case, incremental adder to Avista's Henry Hub pricing has a starting price of \$9.89 per metric ton starting in 2018 and ramps up to \$19.93 by 2035.

Risk Reduction Value

NW Natural provided risk reduction values based on the method previously agreed to by stakeholders engaged in review of NW Natural's IRP. Beginning in 2021, each year of the forecasted risk reduction value is negative. According to a previous agreement resulting from an OPUC process that included stakeholder input, the risk premium value is intended to be an economic 'benefit' to the system. It was determined that the potential of having a negative risk premium in certain years warranted leveling the value across all years. Additionally, it was determined that in the event that the leveled value is negative, then the value used will be \$0. This happens to be the case for this update, so a risk reduction value of \$0 was used.

Gas Avoided Cost Results and Comparison

Compared to the current avoided costs, the new avoided costs are lower for measures with shorter expected lives and higher for measures with longer lives. This is primarily due to two factors: 1) The gas price forecast predicts very low prices for the short term and 2) The valuation of Supply and Distribution Capacity Values provided by NW Natural reflect about a 10X increase in supply capacity costs in year 10, resulting in a disparity in value for measures less than 10 years and those with lives greater than 10 years.

This impact is best observed in avoided costs for commercial strategic energy management (SEM) measures, which use the commercial heating load profile and have a 5 yr. measure life. The net present value of avoided costs for this measure declined 23.3% from the 2016 avoided costs while the avoided cost for a commercial boiler measure with a load profile for commercial heating and a 35-year measure life increased 32.0%. The difference illustrates the importance of load shape and measure life in determining value, and how much that has changed with the new approach.

Table 2. Net Present Value per first year therm

Measure	Load Profile	Measure Life	Label	New (2018 Blended AC \$/therm)	Old (2016 Blended AC \$/therm)	% Change from old (2016 AC) to new (2018 AC)
Commercial SEM	Com Heating	5	Commercial SEM, 5 yrs	\$1.66	\$2.16	-23.3%
Commercial Boiler	Com Heating	35	Commercial Boiler, 35 yrs	\$12.11	\$9.17	32.0%
Commercial Gas Fryer	Flat	12	Commercial Gas Fryer, 12 yrs	\$3.66	\$4.33	-15.4%
Commercial Cust. Heat Recovery	Com Heating	25	Commercial Cust. Heat Recovery, 25 yrs	\$9.51	\$7.73	23.0%
Measure	Load Profile	Measure Life	Label	New (2018 Blended AC \$/therm)	Old (2016 Blended AC \$/therm)	% Change from old (2016 AC) to new (2018 AC)
Industrial SEM	Flat	5	Industrial SEM, 5 yrs	\$1.44	\$2.02	-28.7%
Custom Industrial Process	Flat	15	Custom Industrial Process, 15 yrs	\$4.59	\$5.15	-10.8%
Custom Industrial Boiler	Flat	35	Custom Industrial Boiler, 35 yrs	\$9.20	\$8.58	7.2%
Measure	Load Profile	Measure Life	Label	New (2018 Blended AC \$/therm)	Old (2016 Blended AC \$/therm)	% Change from old (2016 AC) to new (2018 AC)
RES Tank Water Heater	DHW	13	RES Tank Water Heater, 13 yrs	\$4.02	\$4.67	-13.9%
RES Showerhead	DHW	15	RES Showerhead, 15 yrs	\$4.64	\$5.20	-10.7%
Residential Insulation	Res Heating	45	Residential Insulation, 45 yrs	\$14.26	\$10.06	41.7%
New Home Construction	Res Heating	35	New Home Construction, 35 yrs	\$12.48	\$9.13	36.7%
Residential Hearths	Res Heating	20	Residential Hearths, 20 yrs	\$7.94	\$6.70	18.5%
Residential Windows	Res Heating	45	Residential Windows, 45 yrs	\$14.26	\$10.06	41.7%

Next Steps for Electric and Gas Avoided Cost Updates

- Beginning in July 2017, Energy Trust will use updated electric and gas avoided costs for 2018 measure and program planning.
 - All measures currently slated for 2018 updates will be reviewed using new avoided costs. Other measures that are not currently scheduled for updates for 2018 implementation will be subject to updates in 2018 for 2019 measure and program planning. Key measures that do not pass the cost-effectiveness test but are considered important for 2018 program implementation may be reviewed by Energy Trust and the OPUC according to established exception protocols.
 - Energy Trust will consider impacts of avoided cost updates for 2018 program cost-effectiveness and report back to the OPUC and utilities accordingly.
- Energy Trust will work with PGE, Pacific Power, OPUC and regional stakeholders to develop a method to better value capacity and T&D deferral value based on utility peaks.
- Energy Trust will participate in the OPUC avoided cost workshops scheduled for this fall.