The Sensitive Side of Cost Effectiveness

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ABSTRACT

The cost effectiveness of energy efficiency (EE) measures, programs, and portfolios is commonly calculated using the Total Resource Cost test (TRC). The TRC values are used to ensure the effective use of public funds in the support of EE programs during portfolio planning and evaluation of accomplishments. The cost effectiveness of a portfolio of EE measures and programs are calculated using numerous inputs with varying levels of uncertainty or changeability. Changes in these inputs due to a change in policy, a change in program plans, or an update in evaluated values can contribute to substantially different TRC values. This paper seeks to describe how changes in inputs can impact cost effectiveness. If a test input is uncertain but it has little effect on cost effectiveness, should it be a priority in an evaluation? In contrast, if a test input is highly uncertain and cost effectiveness is highly sensitive to that value, it almost certainly makes sense to put effort into studies that will decrease the uncertainty. How much does the effective useful life affect TRCs? Would an increase in incentives make a program's TRC drop below one? What are the effects of an increase in avoided costs?

This paper describes a scenario analysis of the TRC using California's portfolio of EE programs from the 2010-2012 program cycle under direction of the California Public Utilities Commission (CPUC). The results of this analysis provides utilities, regulators, and evaluators the information they need to interpret the sensitivity of the TRC and help to focus evaluations, policy decisions, and program planning on the inputs which are most influential.

Introduction

This Cost Effectiveness Sensitivity Analysis was performed to provide a better understanding of the sensitivity of the Total Resource Cost test (TRC) to specific input parameters. This analysis was based on California's energy efficiency programs from 2010-2012 under direction from the California Public Utilities Commission. The findings presented in this paper illustrate the sensitivity of the TRC to adjustments in specific input parameters. In addition, the findings describe why the TRC's sensitivity to specific parameter changes can be different across portfolios with a different mix of measures and program types.

Overview of the Tests

To understand the sensitivity of the cost effective (CE) test, it is helpful to examine the formulas associated with the CE test that was used for this analysis. This is California's approved formula, while other states have slightly different variants.

The TRC is defined below:

$$TRC = \frac{NPV\ (Net\ Avoided\ Cost\ Benefits)}{Gross\ Program\ Costs + \ (Net\ Participant\ Incremental\ Measure\ Cost)}$$

To get a better understanding of the interplay of the adjustment of various parameters, the numerator and the denominator of the TRC are described in detail below.

Numerator

$$NPV(Benefits) = \sum_{t=1}^{EUL:RUL} \frac{UtilAvoidCost_t + TaxCredit_t}{(1+DiscountRate)^{t-1}} + \sum_{t=1}^{EUL:RUL} \frac{UtilAvoidCost_{AltFuel,t} + PartAvoidCost_{AltFuel,t}}{(1+DiscountRate)^{t-1}}$$

UtilAvoidCost = NTGR*Energy Savings*(Generation Avoided Cost + T&D Avoided Cost) + NTGR*Demand Reduction*Capacity Avoided Cost

$PartAvoidCost_{AltFuel}$ = Participant avoided device and energy supply cost associated with fuel substitution (e.g. natural gas)

Denominator

$$NPV(Costs) = \sum_{t=1}^{EUL:RUL} \frac{GrossPrgmAdminCost_t + NetPartIncCost_t}{(1+DiscountRate)^{t-1}} - \sum_{t=1}^{EUL:RUL} \frac{UtilIncreaseSupplyCost_{AltFuel,t}}{(1+DiscountRate)^{t-1}}$$

GrossPrgmAdminCost = (Administrative + Incentive + Direct Install Labor + Material)
NetPartIncCost = NTGR*((Incremental Measure Cost – Incentive) + (Direct Install Labor + Materials))
$UtilIncreaseSupplyCost_{AltFuel}$ = Increased supply cost for utility supplying alternative fuel

The Utility Avoided Costs in the numerator include avoided generation costs, avoided Transmission and Distribution costs, and avoided capacity costs based on the net energy and demand savings. The Gross Program Administrative Costs in the denominator include the administrative, incentive, and direct install labor and materials costs. The Participant Incremental Measure Cost depends on the type of measure. For early replacement measures, the participant incremental measure cost is the cost of the measure minus the value of the rebate. For direct install programs, the rebate is traditionally replaced with the cost of the direct install labor and materials. For replace on burn out measures, the participant incremental measure cost is the incremental cost of the measure over the cost of the standards based measure minus the value of the rebate.

It is important to note, that in general, the rebate and direct install costs enter into both the Gross Program Costs and the Net Participant Incremental Measure Costs. If the Net to Gross Ratio (NTGR) for a measure is one, the value of rebates cancel in the denominator as rebates add to program costs and subtract from measure costs.

Parameter Adjustments

The parameters adjusted as part of this cost effectiveness sensitivity analysis were chosen since they are often subject to evaluations and/or policy related decisions. They included the following nine inputs:

- Expected Useful Life (EUL): Impacts the avoided cost benefits.
- Unit Energy Savings (UES): Impacts the avoided cost benefits.

- Gross Realization Rate (RR): Impacts the avoided cost benefits.
- Growth Rate of the Avoided Cost Benefits: Impacts the avoided cost benefits.
- Gross Measure Cost (GMC): Impacts the participant measure costs.
- Rebates (Incentives and Direct Install Costs): Impacts the program costs.
- Net-To-Gross Ratio (NTGR): Impacts the net value of avoided cost benefits and participant measure costs.
- Discount Rate: Impacts the net present value of avoided cost benefits.
- Administrative Costs (Non-Incentive Program Costs): Impacts the program costs.

As indicated above, many of the parameter adjustments work to modify the value of the Avoided Cost Benefits. It is important to note, however, that the impact of the adjustment to the parameter, whether it is the EUL, UES, or the growth in the Avoided Cost stream of benefits, does not always lead to the same change in the value of avoided costs and ultimately to the TRC.

Analysis Methodology

To develop a basic understanding of the sensitivity of the TRC to a specific parameter adjustment, the sensitivity was tested with California's currently approved excel-based cost effectiveness calculator populated with a limited number of measures. The measures were chosen to include both gas and electric measures, measures with low and high participant costs, and measures with a distribution of characteristics (e.g., EULs, incentives, etc.). This helped identify that the sensitivity of parameter changes on the TRC can be specific to measures, and that the distribution of these measures within the portfolio can have substantial impact on the sensitivity of the portfolio level TRC.

After developing a basic understanding of the effects of the different parameters on a limited scale, the analysis was expanded using a SQL database tool to facilitate a large scale analysis of the measures, the programs, and the portfolio. These three levels of analysis were performed to provide a more thorough picture of how the measure mix and program type mix of a portfolio might affect the overall portfolio's cost effectiveness. The data used for this analysis were the ex ante claimed program tracking data from the 2010-2012 program cycle. No Codes and Standards programs were included. All net present value (NPV) calculations had 2010 as the base year. California's portfolio also includes non-resource programs which includes programs such as marketing and outreach, audits, and workforce trainings. These programs do not result in measure specific savings and therefore, they are only included in the portfolio level cost effectiveness analysis.

Sensitivity Scenarios

A number of parameter adjustment scenarios were developed for the sensitivity analysis. Table 1 provides a high-level overview of the scenarios and the impact of parameter adjustments on the measure level TRC.

On a statewide portfolio basis, the results of the sensitivity scenarios were summarized for the TRC in Figure 1. This chart shows the base case TRC for the entire portfolio of Resource and Non-Resource programs followed by the results of high and low scenarios of the various parameter adjustments. The high and low scenarios involved changing each parameter individually by plus and minus 25 percent, respectively. Each parameter's uncertainty and variability is different within a portfolio's measure and program mix. For this analysis, plus and minus 25 percent was used for all parameters, but one should consider the actual variability of the specific portfolio's parameter in any decisions regarding allocating resources towards refining a specific parameter estimate.

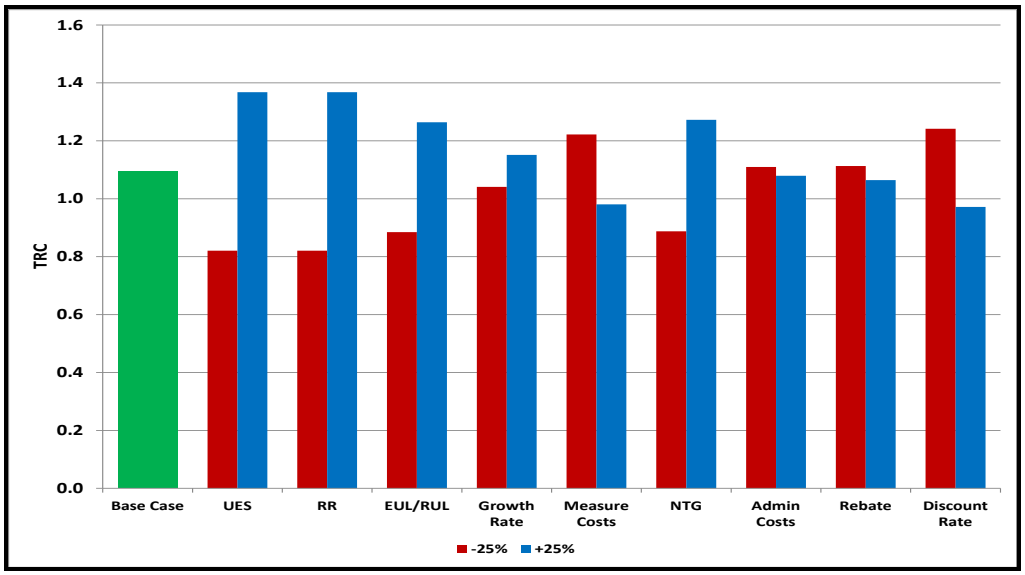

Figure 1. Statewide Portfolio TRC Sensitivity Analysis

Reductions in unit energy savings (UES) and gross realization rates (RR) translate directly into changes in the measure level TRC while changes in the other parameters that were analyzed have a more nuanced impact on the measure level TRC. The sub-sections below describe how the individual parameter adjustments impact the measure level TRC.

Table 1. Parameter Adjustment TRC Impacts

Parameter	Adjustment	TRC Impact
Unit Energy Savings	25% Reduction	25% Reduction in TRC
Unit Energy Savings	25% Increase	25% Increase in TRC
Gross Realization Rate	25% Reduction	25% Reduction in TRC
Gross Realization Rate	25% Increase	25% Increase in TRC
Expected Useful Life	25% Reduction	16-26% Reduction in TRC, measures with shorter life have a larger reduction
Expected Useful Life	25% Increase	0-22% Increase in TRC
Avoided Costs	25% Reduction in Growth Rate	2-10% Reduction in TRC
Avoided Costs	25% Increase in Growth Rate	2-11% Increase in TRC
Measure Cost	25% Reduction	0 to 28% Increase in TRC, zero for measures with no participant cost and over 25% for measures with very high participant cost relative to program cost
Measure Cost	25% Increase	0-18% Reduction in TRC, dependent on NTGR and measure cost relative to program costs
Net to Gross Ratio	25% Reduction	2-25% Reduction in TRC, for measures with zero participant cost a 25% reduction, 8-18% reduction for many measures
Net to Gross Ratio	25% Increase	1-25% Increase in TRC, for measures with a high NTGR. 5-14% typical

Parameter	Adjustment	TRC Impact
Program Administrative Costs	25% Decrease	0-10% Increase in TRC, dependent on the relative size of allocated admin costs.
Program Administrative Costs	25% Increase	0-14% Decrease in TRC, dependent on the relative size of allocated admin costs. As the admin costs increase relative to the incentive costs, the impact of further increases grows
Incentives & Direct Install Costs	25% Decrease	0-9% Increase in TRC, typically 1-4%. Measures with a low NTGR have a larger improvement in TRC
Incentives & Direct Install Costs	25% Increase	1-7% Declines in TRC, typically 1-4%. If allow increase in direct install costs for measures with zero participant cost TRC declines by approximately 20%.
Discount Rate	25% Decrease	5-22% Increase in TRC. Measures with a longer life have a larger increase
Discount Rate	25% Increase	5-17% Decrease in TRC. Measures with a longer life have a larger decrease

Unit Energy Savings and Gross Realization Rate

The unit energy savings and the gross realization rate are both input parameters that are frequently under review as part of evaluation activities. The uncertainty of these values can vary significantly depending on the measures within the portfolio. Each assumption used to estimate energy savings (such as hours of operation, baseline technology, and installed efficiency level) has its own level of uncertainty making these values heavily scrutinized. Reducing the UES or the gross realization rate by 25% generally leads to a 25% reduction in the measure level TRC. This reduces the NPV of the Net Avoided Cost Benefits by 25% leading to the direct 25% reduction in the TRC. Similarly, increasing the UES or the gross realization rate by 25% leads to a 25% increase in the measure level TRC. These are the only input parameters where the change in the parameter has an equivalent effect on the TRC. As a result, a measure with a significant amount of savings and a high uncertainty is a good candidate for allocating evaluation resources to reduce uncertainty.

Expected Useful Life

The effective useful life of a measure is an input whose effect is likely of interest in both policy related program planning and determining evaluation activities. These nuanced effects should be considered as some regulators are focused on achieving portfolios with persistent savings and others are focused on a near term portfolio effect. In addition, the evaluation activities to reduce the uncertainty of a EUL can vary considerably from researching manufacturers' rated lifespan to doing high cost lab studies or even higher cost onsite data collection.

Reducing the EUL by 25% generally leads to a reduction in the measure level TRC of 15-23% for the measures analyzed. Reducing the EUL by 25% reduces the NPV of the Net Avoided Cost Benefits. Because the reduction in the EUL eliminates years far in the future, the avoided cost benefits from the eliminated years of life are discounted by the NPV formulation. The discounting leads the reduction in EUL to have a larger impact on measures with a shorter life than on measures with a longer life.

For example, if a measure has a 20-year EUL, a 25% reduction reduces the EUL to 15 years. If the measure provides a constant avoided cost benefit of $1 per year, a 25% reduction in the EUL leads to a 12% reduction in the NPV of avoided cost benefits using a discount rate of 8.4%. In comparison, if a measure's

EUL is 10 years, the same 25% reduction in EUL leads to a 7.5-year measure life. If this measure also provides a constant avoided cost benefit of $1 per year, the 25% reduction in EUL leads to an 18% reduction in the NPV of avoided cost benefits. So while a measure with a longer EUL might have more uncertainty, it might not be more beneficial to spend resources to decrease uncertainty than a more certain measure with a shorter EUL might have.

Growth in Avoided Cost Benefits[1].

The assumed growth rate in the creation of the avoided costs is heavily influenced by policy. It is helpful for policy makers to understand how this parameter affects a TRC for discussions about these policy assumptions.

The dollar valuation of avoided cost benefits are modeled to increase over time. For the commercial gas avoided costs, the growth in the dollar valuation of avoided cost benefits has a maximum growth rate of 17.3% in parts of 2011, a minimum of 0.9%, and an average of 3.9%. For the commercial electric generation avoided costs, the growth in the dollar valuation of avoided cost benefits has a maximum of 6.55% in parts of 2011, a minimum of 1.0%, and an average of 2.9%. For the scenarios described in this paper, we reduced the growth rate of the avoided cost benefits by 25% and increased the growth rate by 25%.

Reducing the growth rate of the avoided cost benefits by 25% reduces the gas measure TRC by 2% to 10% and the electric measure TRC by 3%-6%. Reducing the growth rate by 25% has a larger impact on the TRC for gas saving measures relative to electric saving measures because of the larger initial growth in the gas avoided costs relative to the electric avoided costs. Since avoided costs grow over time, reducing the initial 17.3% growth of the gas avoided costs has a larger and long lasting impact on the cost effectiveness of gas savings measures.

The size of the impact of a 25% reduction in the rate of growth of avoided cost benefits on the cost effectiveness of measures is dependent on the underlying rate of growth of the avoided costs. Reductions in the rate of growth will have a larger impact if the initial rate of growth is higher and a smaller impact if the initial rate of growth is slower. The growth rates in the gas and electric avoided costs are both relatively high in years 2011 and 2012 relative to the remaining 20-year forecast period.

Increasing the growth rate of the avoided cost benefits by 25% increases the gas measure TRCs by 2-11% and the electric measure TRCs by 3-7%. Increasing the growth in the avoided cost benefits has a larger impact on the gas measures because the original rate of growth is higher for gas measures.

Gross Measure Costs

Gross measure costs for a specific technology can vary based on prices from different retailers and manufacturers, which leads to a level of uncertainty. Some program applications might collect this information, but more often than not, gross measure cost has a level of uncertainty associated with it. Requiring that a program implementer collect this data or having an evaluator perform a study on measure costs can both be costly efforts. The effects of this parameter are largely dependent upon the type of program being implemented.

Reducing the Gross Measure Costs. The effect of reducing the gross measure cost by 25% on the measure level TRC was very dependent on the value of the measure cost and the size of the measure cost relative to the size of the program costs (measure costs and program costs are summed in the denominator of the TRC).

[1] This section discusses the impacts of the growth rates as used in the creation of the avoided costs in California. Results might vary if another state's avoided costs were used in the analysis, which uses different growth rate assumptions.

If the measure is a direct install measure such that the customer's participant measure cost is zero, reducing the measure cost by 25% does not impact the measure level TRC. A 25% reduction in zero is zero, so no change in the measure cost is assumed for these customers. Therefore, not surprising, there is no change in the TRC for these measures.

Alternatively, when the measure is a high cost measure, reducing the measure cost by 25% has a substantial impact on the measure level TRC. Determining the specific impact of a reduction in the measure cost on the measure level TRC is important to understand the relationship between the Gross Program Costs and the Net Participant Measure Costs. When the Net Participant Measure Costs are large relative to the Gross Program Costs, then reducing the measure costs by 25% leads to more than a 25% increase in the measure level TRC. Alternatively, when the Gross Program Costs are large relative to the Net Participant Measure Costs, reducing the measure costs by 25% leads to less than a 25% increase in the measure level TRC.

For measures with a NTGR of approximately 0.9, if the participant measure cost is approximately 3 times the program cost, a 25% reduction in the participant cost leads to approximately a 25% increase in the TRC. For this same measure, if the participant measure cost is ten times the program cost, a 25% reduction in the participant measure cost leads to approximately a 29% increase in the TRC. Alternatively, if the participant measure cost is twice the program costs, a 25% reduction in the measure cost leads to approximately a 20% increase in the TRC.

If the measure described in the previous paragraph has a NTGR of 0.7, and the measure cost to the customer is approximately 3 times the program cost, a 25% reduction in the participant measure cost leads to approximately a 21% increase in the TRC. A lower NTGR decreases the impact of a reduction in the measure cost on the TRC.

The intricate relationships between the participant measure cost, program costs, and NTGR make it difficult to uniquely describe the impact of a reduction in the measure cost on the measure's TRC. Developing a more complete understanding of the impact of a portfolio wide 25% reduction in the measure cost on the TRC necessitates a portfolio specific analysis given the distribution of measures with zero costs to customers, high costs to customers, various relationships between measure and program costs, and a distribution of NTGRs and is shown in Figure 1 above.

Increase in the Gross Measure Cost. The effect of increasing the gross participant measure cost by 25% on the measure level TRC was also very dependent on the value of the participant measure cost and the size of the participant measure cost relative to the size of the program costs (measure costs and program costs are summed in the denominator of the TRC).

For some direct install measures, it was not possible to reduce the price of the measure because the customer had no cost for the measure or the Gross Participant Cost was zero. If there is a 25% increase in the gross measure costs for direct install measures, the impact on the measure level TRC is very dependent on how/if the increase is allowed to flow down to the customer. For many direct install measures, it appeared that the gross measure costs were exactly equal to the sum of the Direct Install Labor and the Direct Install Material. If a 25% increase in the gross measure costs directly leads to an increase in the Labor and Material costs, then the 25% increase will not lead to any change in the TRC. Alternatively, if a 25% increase in the gross measure costs does not lead to any change in the Labor or Material costs such that the Gross Participant Costs are allowed to increase by 25%, increasing the GMC will lead to a decrease in the measure level TRC.

While the specific impact of a 25% increase in the gross measure costs is dependent on the relative size of the gross measure costs and the program cost and on the measure level NTGR, a 25% increase in the gross measure costs leads to a smaller percentage decline in the TRC. For most measures, a 25% increase in the GMC leads to a 14-19% decline in the TRC.

It is easier to specify the impact of an increase in the gross measure costs on the TRC because the multiplication of the gross measure costs by the NTGR implies that the percent increase in the gross measure costs is muted by the NTGR. If program costs were zero and the NTGR was 1.0, a 25% increase in the gross measure costs leads to a 25% decline in the TRC. As the program costs grow, the impact of an increase in the gross measure costs on the TRC declines. Similarly, as the NTGR falls from 1.0, the impact of an increase in the gross measure costs on the TRC declines.

Net to Gross Ratio

The net to gross ratio is another parameter that is frequently subject to evaluations and policy decisions. In California, the net to gross ratio can be thought of as "net of free ridership," while other jurisdictions might be "net of free ridership plus spillover effects from the program." Therefore, the net to gross ratio can vary due to both uncertainty and policy decisions. The program implementation type has a large effect on the variability of the TRC due to a change in the net to gross ratio.

Reducing the NTGR by 25% impacts both the numerator and the denominator of the TRC. The effect of reducing the NTGR by 25% is very dependent on the size of measure costs and the size of the measure costs relative to the program costs.

If the measure is a direct install measure such that the customer's measure cost is zero, reducing the NTGR by 25% only impacts the numerator of the TRC. For cases where the customer's measure cost is zero, reducing the NTGR by 25% leads to a 25% reduction in the TRC.

If the measure is a high cost measure and the measure costs are high relative to the program costs, a 25% reduction in the NTGR impacts the numerator and the denominator by similar amounts. Because adjustments to the NTGR do not impact the gross program costs (in the denominator of the TRC), the reduction in the NTGR leads to a small reduction in the measure level TRC. Alternatively, if the measures are small relative to the program costs, a 25% reduction in the NTGR leads to a larger impact on the TRC, but the impact is less than 25%.

Program Administrative Costs

The program administrative costs are generally a known input. During the portfolio planning stage, a program administrator might want to test different scenarios to determine a plan that optimizes the TRC. Additionally, policy makers might set standard caps for administrative costs, and therefore, understanding the potential effects of changes to this input are valuable.

Changing the program administrative costs impacts the denominator of the TRC. Increasing the program administrative costs reduces the TRC while decreasing the program administrative costs increases the TRC. As part of the scenario analysis, we reduced and increased the program administrative costs by 25%. These changes led to a 0-14% change in the TRC. The exact influence of a change in administrative costs on a measure level TRC depends on the allocation of the program measure costs to the measure, the size of the other program costs (incentives and direct labor costs) and the size of the net participant measure costs.

For this analysis, the allocation of administrative costs for a program to a specific measure is based on the share of program savings attributed to the measure. Measures with a high level of program savings are attributed a high share of the program administrative costs.

Developing a more precise understanding of the size of the measure level impact of a change in program administrative costs on measure level TRCs required the implementation of scenario analyses at the program level. The findings, however, indicate that for the majority of measures, the impact of a 25% increase or decrease in administrative costs will have only a 0-4% change in measure level TRC. Those

programs with greater changes in the TRC tend to have Administrative Cost allocations that are a higher percentage of the total TRC costs. This is illustrated in Figure 2.

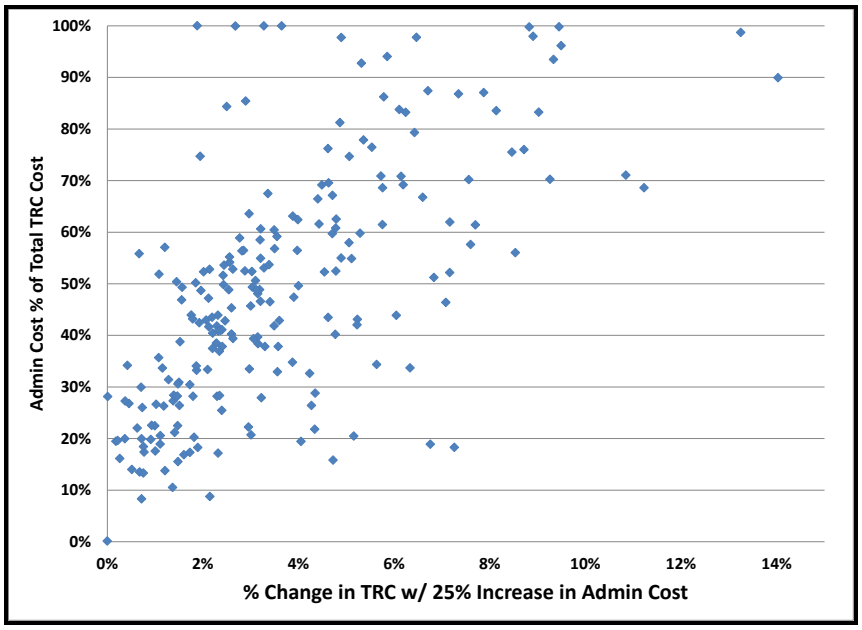

Figure 2: Change in TRC vs. Admin Cost % of Total TRC Cost

Incentives and Direct Install Labor and Materials Cost

Similar to the administrative costs, the incentives and direct install labor and materials costs are known inputs to the cost effectiveness calculation. Understanding the effects of changes in incentives and direct install costs are important for program administrators and policy makers when planning for a portfolio of programs.

Increasing the incentives and direct install labor and materials costs impacts both the program costs and the participant incremental measure costs. The effects of these changes are opposite, but not usually equal. In the TRC equation provided above, the denominator is the sum of the gross program costs and the net participant incremental measure costs. An increase in incentives increase the gross program costs and decreases the gross participant incremental measure costs by equal amounts. But the TRC incorporates the net participant incremental measure cost, not the gross. If the NTGR is less than one, an increase in incentives will increase the denominator of the TRC and lead to a reduction in the measure level TRC.

Given that the increase in incentives and direct install costs is largely cancelled out, a 25% increase in incentives leads to a relatively small decline in the TRC. This impact is usually less than 4%. Measures with low NTGRs, holding all else constant, experience a larger decline in their measure level TRC when incentives are increased.

If incentives are decreased, there is a decrease in program costs and an increase in participant measure costs. Because the participant measure costs are multiplied by the NTRG, the impact of the decrease in program costs is larger than the increase in participant measure costs. A 25% decrease in incentives was associated with a 1-10% increase in the TRC, with typical increases less than 4%.

Discount Rate

The discount rate is currently set to about 8.4% in California. This value varies throughout the country, but the behavior of such changes still holds true for other jurisdictions. The discount rate is used in the TRC to discount future avoided cost benefits. This input is subject to policy decisions.

If the discount rate is increased by 25% to 10.5%, then future avoided cost benefits are discounted more relative to the current parameter values. The increased discounting leads to a reduction in the present value of avoided cost benefits and a decline in the TRC. The longer the measure's EUL, the more the increase in the discount rate impacts the value of avoided cost benefits. A 25% increase in the discount rate reduced the TRC benefits approximately 5% for measures with relatively short lives (residential CFLs) and by approximately 16% for measures with a 20 year expected useful life.

A 25% reduction in the discount rate to 6.3% reduces the discounting of future avoided cost benefits leading to an increase in avoided cost benefits and the TRC. For measures with relatively short lives, a 25% reduction in the discount rate led to a 5% increase in the TRC. For measure with 20 year expected useful lives, a 25% reduction in the discount rate led to a 20% increase in the TRC.

Alternatively, if the discount rate is increased by 50% to 12.6%, the measure level TRC will decline from 10-28% relatively to the current values with a discount rate of 8.4%. If the discount rate is decreased by 50% to 4.2%, the measure level TRC will increase from 11-47% relative to their current values.

Results by Direct Install versus Non-Direct Install

It may be useful to examine the sensitivities at the program level by different program types. In this section, we present the results of the analysis by Direct Install versus Non-Direct Install. For Direct Install (DI) versus Non-Direct Install measures, there are significant differences seen in their sensitivities to gross measure costs and NTG adjustments. Also, as mentioned earlier, if the measure cost is such that the participant cost is zero, negative adjustments to measure cost have no effect on the TRC.

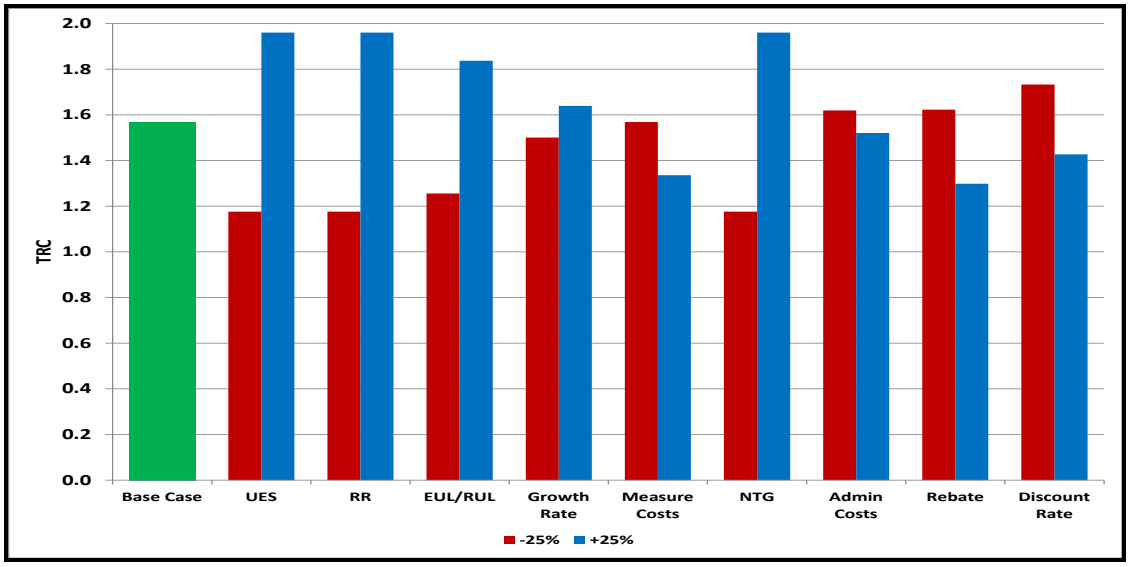

Figure 3: Direct Install TRC

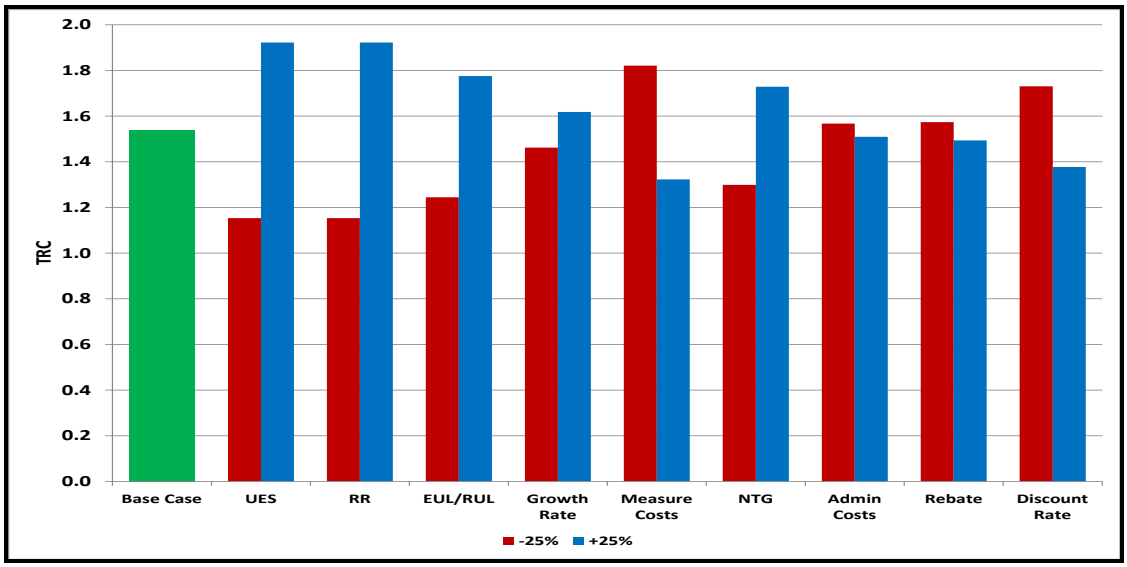

Figure 4: Non-Direct Install TRC

Since the DI participant costs are zero, the numerator of the TRC is affected by changes in NTG much more so than the denominator making DI more sensitive to NTG adjustments.

Results for Highly Uncertain Measures

Based on the measure mix in the California portfolio for 2010-2012, we further examined the measures that are considered to be highly uncertain. The list that was developed was a combination of those measures from the Energy Savings Performance Index (ESPI) which are noted to be the more uncertain measures in the portfolio and Itron's own professional judgment of measures of interest. The resulting measures list includes CFLs, Computer Power Management, Delamping of Linear Fluorescents, Home Energy Surveys, HVAC Performance Quality, LEDs, Linear Fluorescents, Occupancy Sensors, Pipe Insulation, Pool Pumps, Water Sprinklers, T5 Linear Fluorescents, and Water Saving Kits.

One area of uncertainty associated with many of these measures is their EUL. Figure 5 shows the sensitivity of these measures to adjustments in their EUL. The vertical axis is the ratio of the adjusted TRC over the base[2] TRC expressed as a percentage of the base. The horizontal axis shows the relevant measure and their savings weighted EUL in years for reference. The most noticeable observation is how similar all these measures are with respect to their sensitivity to EUL adjustments. The EUL affects the net present value of the benefits and costs. Because a reduction in the EUL eliminates years far in the future, the avoided cost benefits from the eliminated years of life are discounted by the NPV component of the TRC equation. The discounting should cause the reduction in the EUL to have a larger impact on measures with shorter lives. This is evident when looking at Home Energy Surveys which has the shortest EUL.

[2] The base TRC scenario is calculated using the actual 2010-12 ex ante program data.

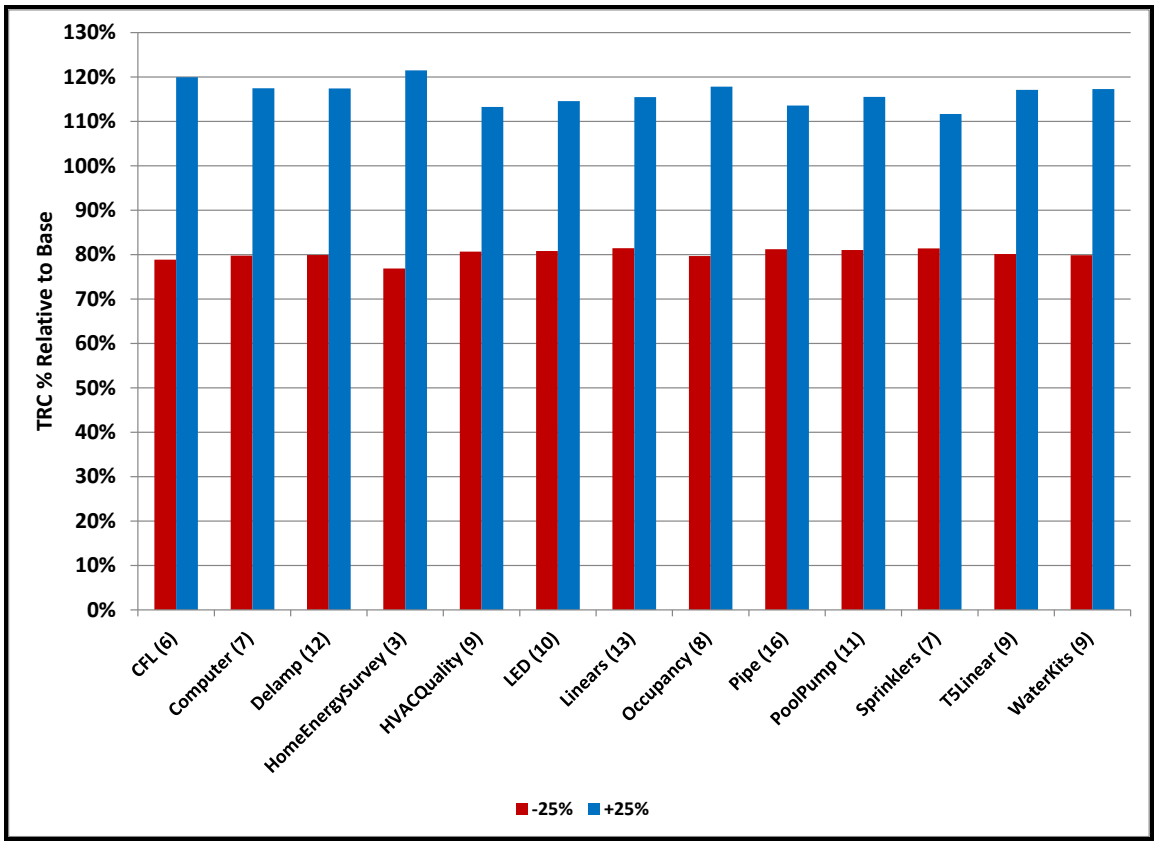

Figure 5. Uncertain Measures – EUL Adjustment Sensitivity

In general, these measures display similar relative sensitivities to the various adjustments. In absolute terms, these sensitivities vary significantly as they have very different base TRC results. For example, the base TRC of Home Energy Surveys (HES) is approximately 0.8 while the base TRC of Pipe Insulation is over 2.

Conclusion

The effects of changes to each input parameter in the TRC calculation is heavily nuanced by a variety of factors related to the make up of a program or portfolio. These inputs are each subject to variability via policy decisions, portfolio planning, and evaluation studies. Before finalizing a new policy or spending public resources on a program or evaluation, it is important to understand the effects these changes might have on the cost effectiveness of a portfolio.