The Misguided Policy of TRC Screening for Individual Custom Projects

Richard Barnes, KEMA, Inc., Oakland, California
Wendy Tobiasson, KEMA, Inc., Oakland California

Abstract

Designing an energy efficiency or load management program is a balancing act. Program designers must minimize barriers such as participant hassle and transaction costs while ensuring that adequate risk management processes are in place. Benefit-cost tests provide designers a set of tools to help achieve appropriate program balance. Requirements such as Total Resource Cost test (TRC) project screening, required co-funding levels, proof of co-funding payment, measurement and verification activities, and cost and savings documentation can mitigate certain risks. These requirements, however, often result in higher program costs and increase participant hassle and transaction costs. Program designers should carefully examine requirements to ensure that the risk management benefits outweigh associated costs. This paper explores and critically reviews the use of the TRC test for various design and implementation applications, including Portfolio Planning, Program Design, Prescriptive Measure Screening, and Custom Project Screening. For each application, this paper describes the specific ways in which the TRC test is used along with the associated rationale. The perceived strengths and weaknesses of using the TRC test are also offered. Finally, this paper offers recommendations to using the TRC test in program design.

The Total Resource Cost Test

Since 1983, *The California Standard Practice for Cost-Benefit Analysis of Conservation and Load Management Programs* has provided useful metrics to justify, design, and implement programs that promote energy efficiency and load management[1][2]. The Standard Practice Manual examines the costs and benefits of energy-related investments from five different perspectives: Total Resource, Societal, Utility/Program Administrator, Participant, and Rate Impact. Utilities. program administrators, state agencies, and others use the tests to help ascertain the economic merits of various programs. The TRC perspective is the most widely used metric and one that is used throughout the entire value chain from portfolio planning to implementation.

According to the Standard Practice Manual, the TRC test measures the net costs of a demand-side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs.

[1] The California Standard Practice Document includes a description of the TRC and other economic tests used to evaluate energy efficiency programs. It can be downloaded at:
ftp://ftp.cpuc.ca.gov/puc/energy/electric/energy+efficiency/em+and+v/Std+Practice+Manual.doc.
[2] EPA's National Action Plan for Energy Efficiency (NAPEE) Report also provides information on a range of economic tests typically used to assess energy efficiency programs. Details on the TRC and other tests can be found in Chapter 6: Energy Efficiency Best Practices.

The TRC ratio can be simplistically expressed as follows:

$$\text{TRC Ratio} = \frac{\text{ARC}}{(\text{IMC} + \text{PAC} - \text{INC})}$$

Where:

ARC is the present value of the avoided resource costs such as fuel costs and utility plant investment
IMC is the present value of the incremental measure cost to obtain the expected energy-related benefits
PAC is the present value of all program costs incurred by the administrator, and
INC is the present value of incentives paid by the program administrator to the participants

The Societal test slightly varies from the TRC test by including the effects of externalities (e.g., environmental, national security) and using a different (e.g., societal) discount rate. While the societal cost incorporates more indepth impacts than the TRC, these values are difficult to quantify.

The Program Administrator Cost (PAC) test considers the same resource benefits as the TRC test; however, it only considers the costs borne by the program administrators and not those borne by the participants. Since the PAC excludes participant costs, the PAC ratio is almost always higher than or equal to the TRC ratio.

The Participant test assesses the economics from the participant’s perspective and excludes all program administrator and larger societal impacts.

The Rate Impact (RIM) test measures the effect on energy rates assuming that all program costs and net energy revenue losses are recovered via energy rates. The benefits for the RIM test are the same as the TRC and PAC tests while the RIM costs include all program costs plus any lost energy sales revenue incurred by the utility.

These tests are not intended to be used individually or in isolation. The results of tests that measure efficiency – the TRC, Societal, and PAC – must be compared not only to each other but also to the Ratepayer Impact Measure test. This multi-perspective approach requires program administrators and state agencies to consider tradeoffs between the various tests.

The California cost-benefit tests were initially designed to assess the comparative value of different program portfolios and program strategies. Over time, numerous parties have also applied the TRC test concept to screen measures for incentive program eligibility. The use of the TRC test as a project eligibility screen is a common practice although not universally adopted.

Program Portfolio Planning

The portfolio planning process identifies an optimal portfolio of program strategies. The expected costs and benefits of a portfolio is only one of many considerations that factor in to the design of a program. Issues such as comprehensiveness, equity, cost sharing policy, and market transformation objectives all play a role in determining the optimal portfolio. The TRC metric is useful when assessing the cost-benefit of different portfolio strategies.

Portfolio planners use the TRC test to assess the cost-benefits for different levels or types of effort while regulators seek such information to set funding levels and goals. The TRC results for scenarios with different levels or types of effort within a specified time period provide insights for setting the appropriate budget and goals.

The TRC test, however, should not be the only metric used to contrast different portfolio strategies. The Societal test may be a more complete value assessment of the different strategies since this test also considers various environmental and non energy-related externalities. Both the RIM and the PAC tests ensure that program costs and incentives are kept as low as possible. Establishing a TRC or Societal test requirement without consideration of the PAC or RIM may lead to a portfolio with higher than necessary incentive levels.

Table 1 provides an illustrative example of three different portfolio strategies. Strategy A reflects a business-as-usual plan with a standard mix of energy efficiency and load management activities. Strategy A seeks to reduce peak demand by 0.5% per year while Strategy B seeks to double the peak demand reduction goal to 1% per year. Strategy C seeks to achieve the same demand reduction goal of Strategy B but does it primarily using demand response measures.

Table 1: Example Portfolio Strategies

	Strategy A	**Strategy B**	**Strategy C**
Resource mix	60% EE, 40% LM	60% EE, 40% LM	30% EE, 70% LM
Demand reduction goal	0.5% per year	1% per year	1% per year
TRC ratio	2.2	2.0	1.8
PAC ratio	2.8	2.4	2.0
RIM ratio	0.8	0.75	1.2
Participant ratio	4.0	3.5	2.0

Demonstrating a typical result, the various ratios tend to decrease as the program activity increases. In general, it is more costly to achieve higher level of savings as one works up the energy resource supply curve. Strategy C, with a higher level of load management activities, provides a better RIM since there is less lost revenue; however, the TRC and PAC ratios of load management programs are often lower than energy efficiency programs.

Some regulators exhibit a preference for program portfolio strategies that do not have an adverse impact on utility rates. These regulators tend to rely more on the RIM test when assessing competing strategies. Energy efficiency programs generally have an adverse impact on rates while load management programs often are designed to have a positive impact on rates. Thus regulators that favor a RIM perspective are more likely to prefer portfolios with a greater portion of load management programs.

Program Screening

The TRC test is often used in the program design process as a screening tool, although its use can be problematic if it is the only metric that is considered. There are often other considerations in program design such as equity or market transformation objectives that may justify offering a program with a TRC ratio less than 1.0.

The TRC test is also a useful metric to assess competing programs designed to serve the same market. The TRC values of the competing proposals from third-party program providers are useful metrics to rank and select a winning provider. However, it is important to consider PAC values as well.

Table 2 provides an example of two competing lighting retrofit programs. In Scenario #2, the program pays a higher incentive to achieve a higher market penetration.

Table 2: Example Lighting Retrofit Programs

	Scenario #1	Scenario #2
Incentive level	40% of IMC	75% of IMC
Achievable Annual Savings	30 GWh	60 GWh
Program admin cost	25% of IMC	20% of IMC
Freeridership	6 GWH	
IMC	$0.30 per annual kWh saved	
NTG ratio	0.80	0.90
PV avoided cost per annual kWh	$0.60 per annual kWh saved	
TRC	1.5	1.6
PAC	2.5	1.8

Paying a higher incentive to achieve greater market penetration will often result in a higher TRC, which is caused by a combination of a higher NTG ratio and the fact that less marketing is needed to inform and attract each participant. The PAC test illustrates that the higher TRC is obtained by shifting costs from the participant to the program. When considering both perspectives, the best strategy is not always obvious.

The TRC test provides a useful program screening tool as long as other factors are considered for programs with a negative TRC. Issues such as comprehensiveness, lost opportunities, and the need to serve hard-to-reach markets may all be valid reasons to pursue a program with a low TRC ratio. In other cases, program activities can reduce the measure cost, which can occur with emerging technologies that have not achieved high volume production and distribution efficiencies. Typically, portfolio level TRCs are over 1.5 and often approach 2.5 so that the average performance well exceeds the TRC screening threshold. Focusing too closely on the 1.0 minimum threshold can result in unrealized efficiency potential in a program because customers install measures and the program cannot take credit for the savings or reduce the program's ability to help drive emerging measures.

Prescriptive Measure Screening

Many prescriptive incentive programs only offer incentives for measures that pass a TRC test as the incentive serves as a defacto endorsement. The use of a TRC screening test helps to ensure that the overall portfolio is cost effective and that program funds are not spent on measures that have a negative TRC.

For example, the TRC test can be used to assess the cost-benefit of the average premium motor or it can be used to assess every combination of motor size and type. It is not uncommon to find a particular motor size and type that does not pass the TRC test although this may have as much to do with the inability to accurately estimate the incremental measure cost at the disaggregated level. Using the TRC to screen-out narrowly defined measures can result in a program design that increases barriers such as higher information search cost and relies too much on uncertain IMC estimates.

Inclusion of non-incentive program costs creates a challenge when screening potential prescriptive measures. The choices for assigning program costs to each measure range from allocating costs in proportion to the accepted resource value, to allocating based on the incentive amount, or to ignoring these program costs all together. The argument for ignoring the non-incentive program costs in the screening process is that on the margin, one additional measure will not have much impact on the total program cost. Allocating non-incentive program costs based on resource value is equivalent to ignoring these costs and increasing the screening threshold.

A common choice among program designers is to allocate program costs based on the amount of incentive paid since this simply requires an estimate of the proportion of the incentive budget compared to all other program costs. For example, if incentives account for 60% of the total program budget, then program-administrator costs for a given measure would be set at two-thirds of the proposed incentive for that measure. This allocation results in a TRC screening approach that is sensitive to the incentive amount; the program designer can simply improve the TRC of a borderline measure by decreasing the incentive. In reality, the non-incentive program cost per measure tends to be lower as the incentive increases because fewer program marketing and technical support services are required to spur participation.

The authors recommend that non-incentive program costs should not be directly considered when conducting TRC screening for prescriptive measures. As the TRC screening criteria can be set at, above, or below 1.0, the program designer has the required flexibility to account for non-incentive program costs as deemed necessary. This approach avoids screening out borderline measures simply due to the manner in which non-incentive program costs were allocated. It also results in a higher level of economic potential and helps to promote a more comprehensive program. It is important to note that measures with a TRC at or near 1.0 will have lower adoption rates and thus will have little impact on the TRC of the overall program or portfolio. Table 3 provides illustrative examples of TRC ratios for selected measures.

Table 3: Example Portfolio Strategies

Measure	Measure kWh Savings	Measure kW Savings	Measure Life	IMC	PV Avoided Cost	Measure TRC
T12 to HPT8 4ft with elect bal	55	0.01	11.0	$16.50	$26	1.55
T12 to SuperT8 8ft with elect bal	74	0.02	11.0	$38.00	$34	0.91
Standard T8 to RWT8 4ft (lamp only)	21	0.00	3.0	$2.10	$3	1.48
Standard T8 to RWT8 8ft (lamp only)	19	0.00	3.0	$5.50	$3	0.53
HID to HE HID						
≤100W	176	0.05	16.0	$95	$116	1.22
>100W to ≤200W	250	0.07	16.0	$170	$166	0.98
>200W to ≤350W	485	0.13	16.0	$266	$322	1.21
HE AC						
5 ton or less Tier 2	84	0.06	15.0	$60	$85	1.41
5 ton or less Tier 3	186	0.11	15.0	$140	$161	1.15
greater than 5 Ton Tier 2	125	0.10	15.0	$118	$127	1.08
greater than 5 Ton Tier 3	182	0.14	15.0	$200	$182	0.91
Premium Motors						
1-5 HP	125	0.05	15.0	$100	$89	0.89
7.5-20 HP	630	0.19	15.0	$200	$416	2.08
25-100 HP	2,079	0.45	15.0	$300	$1,249	4.16
125-200 HP	4,298	0.81	15.0	$500	$2,487	4.97
ENERGY STAR Freezers						
19-30 cuft	1,201	0.14	12.0	$600	$534	0.89
31-60 cuft	2,077	0.24	12.0	$856	$921	1.08
61-90 cuft	3,303	0.38	12.0	$1,859	$1,464	0.79
Energy Efficient Ice Machines						
less than500 lbs	1,606	0.18	12.0	$537	$711	1.32
500-1000 lbs	3,176	0.36	12.0	$1,485	$1,406	0.95
1000-1500 lbs	5,019	0.57	12.0	$1,821	$2,222	1.22
Refrigeration						
Strip Curtains	139	0.01	4.0	$8	$22	2.80
Night covers for displays	105	0.03	10.0	$35	$50	1.44
EC Motors for Walk-ins	401	0.04	15.0	$250	$207	0.83
EC Motors for Reach-in	345	0.03	15.0	$185	$176	0.95
Evaporative Fan Controller	478	0.06	16.0	$291	$266	0.91
Auto Door closer for Freezers	2,360	0.32	8.0	$433	$778	1.80
Auto Door closer for Ref Walk-in	900	0.14	8.0	$400	$305	0.76
Anti Sweat Heater Controls	267	0.00	12.0	$34	$99	2.90

The examples show how a strict adherence to TRC screening may create undesired holes in the program offerings. There are no hard and fast rules for when to screen a measure based on TRC results. One factor to consider is whether there is a more cost-effective alternative to the measure. For example, 8-foot T8 lamps are expensive and one-for-one retrofit with these types of lamps do not produce sufficient savings to pass the TRC. Some programs do not offer incentives for retrofits involving 8-foot T8 lamps since it is possible to install two 4-foot T8 lamps as an alternative.

There are several measures in the table such as premium motors that demonstrate where a specific size category does not pass the TRC. In these cases, it is usually preferred to not screen out the specific size categories that do not pass. Additionally, specific IMCs are often rough estimates, which can be a factor in the decision to exclude specific measure sizes and types. Program designers can encourage comprehensive programs while minimizing market confusion and administrative hassles by accepting that a few participants may install a measure that does not pass the TRC.

The refrigeration measure examples are more complicated. Measures such as EC motors and auto closers for walk-in refrigerators do not pass the TRC test. It could be reasonable to exclude these measures based on the economic screening, but it is also worthwhile to consider including the measures in the program in pursuit of comprehensiveness and maximizing the resource potential.

While program designers must develop a plan that on aggregate meets the TRC, they need to also consider the overall expected measure mix. Typically low TRC measures are unlikely to make up a big portion of the program because they are by definition less economically favorable. The measure mix can then still include some measures that are at or below the threshold on an individual basis as long as the overall program average achieves the desired overall program cost effectiveness.

Custom Project Screening

Many programs require that each custom project and in some cases, each custom measure, pass a TRC screening test. The process requires gathering information from the participant and other sources to determine the incremental measure costs as well as the expected resource value resulting from the project. Factors such as expected measure life and the load profile of savings must also be considered to develop a project-specific or measure-specific TRC. As with prescriptive-measure screening, the inclusion or exclusion of non-incentive program cost into the TRC test must also be addressed.

Conducting the TRC test on custom projects ensures that program funds are not spent on projects that have “poor” economics from a total resource cost perspective. This approach also helps ensure that the overall custom incentive program will have a positive TRC. An additional argument to support TRC project screening for custom projects is that it is simple to implement. It does not significantly increase participant hassle and transaction costs as it is common to gather the required information such as incremental measure costs.

The problem with TRC screening of custom projects is that the process itself can reduce the likelihood of project implementation, independent of whether the project is cost-effective. Including a TRC test requirement adds additional uncertainty and risk to the sales process thus creating yet another “barrier” that must be overcome by both the seller and buyer. It also creates a fairness concern in that one of two projects that produce identical resource values might not be eligible for an incentive simply because the participant is willing to pay more for the measure (i.e., has a lower discount rate) or obtains non-energy benefits from the project that were not adequately addressed in the TRC test.

As an example, consider the purchase of an energy management system (EMS). A participant may be motivated to purchase an EMS because they can implement control strategies that will result in energy savings. However, the EMS will also provide other benefits such as better comfort control, lower operation and maintenance costs, and demand response capability. Only a portion of the EMS cost should be considered as the incremental measure cost to achieve the energy savings. The first inclination is to estimate the cost of an EMS system that provides the non-energy benefits without any energy benefits. However, the process of obtaining the baseline cost estimate is not a straight forward task and is viewed as a burdensome transaction cost by the participant and its vendor. The estimation of the IMC tends to be highly uncertain and a subjective process.

In practice, participants quickly learn how to overcome a project's TRC screening process. They can work with their vendors to break the project into its energy related and non-energy related components. The participant and vendor can allocate the project cost to ensure that the TRC test is passed.

An alternative to TRC project screening is to develop an incentive structure that places the total burden of higher IMC on the participants. If the participants determine that the total value is sufficient to justify the investment, the program administrator should be indifferent as long as they are not subsidizing the investment associated with the non-energy benefits.

Custom projects use a variety of incentive structures. Most incentive structures can be classified as either being primarily cost-based or value-based. Cost-based incentive structures are those that tend to pay a higher incentive as project costs or IMC increases. Incentives that are based on a percentage of the project cost and those that buy-down the project cost to achieve a fixed payback period are the two most common examples of cost-based incentives.

Value-based incentive structures generally set incentive levels based on the amount of annual kWh saved, lifetime kWh savings, KW savings, or some combination. An incentive structure that pays X cents per annual kWh saved is a value-based incentive structure even though it does not perfectly account for the actual resource value obtained. While it is possible to develop a custom incentive that pays a portion of the expected resource value, this approach is often deemed too complicated by the various market actors. While complicated incentive structures may be better aligned with program objectives, they often create additional barriers that outweigh the gains associated with better alignment.

In the case of a cost-based incentive structure, considerable effort is expended during analysis and documentation of the IMC or project cost. The TRC test serves a useful purpose for these incentives by ensuring that program funds only subsidize projects that provide a positive net total resource benefit. The incremental participant hassle and program costs associated with a TRC test are negligible when a cost–based incentive structure is used.

While most programs with cost-based incentives use the TRC test to screen high-cost projects from obtaining an incentive, an alternative approach might also be considered. The TRC test can be used to limit the amount of incentive paid and thus shift the "non-economic" cost burden onto the participant. If the participant truly views these costs as "non-economic", they will be unlikely to proceed with the project. If they consider these costs as investments that produce non-energy benefits, they may be likely to pursue the project.

Limiting incentive costs in a cost-based structure can be a fairly straightforward calculation. One possible calculation is provided below.

Revised Incentive = Original Incentive * ARC / IMC

The ARC/IMC ratio in the above equation is the TRC ratio if we assume that non-incentive program costs are negligible. Thus the incentive can simply be reduced by a factor equal to the TRC ratio as a means to shift the non-economic portion of the project cost to the participant. The advantage of the above approach is that it ensures that the incentive paid will not be greater than the resource value. In fact, the only case where the incentive will equal the resource value is when the incentive structure allows the original incentive to be equal to 100% of the IMC. Most cost-based structures do not pay 100% of the IMC.

For example, let's consider a custom incentive program that pays 50% of the measure cost. A potential project has an IMC of $10,000 and produces a resource value of $20,000. Ignoring non-incentive program costs, this would produce a TRC ratio of 2.0. The participant would receive an incentive of $5,000.

If the same project cost had an IMC of $20,000, it would have a TRC of 1.0 and would result in an incentive of $10,000. The primary weakness of most cost-based incentives then becomes apparent: the project with higher costs and identical benefits, receives a higher incentive. If the same project had an IMC of $30,000, it would result in a TRC of 0.67. The 50% IMC incentive would be equal to $15,000. Applying the proposed adjustment would lower the incentive to $10,000. The additional IMC cost of $10,000 ($30,000 - $20,000) is fully assigned to the participant.

While the adjustment described above is an effective means to shift non-economic costs to the participant, a cost-based incentive can not overcome the situation in which a higher incentive is paid for projects with higher cost, regardless of the resource value that is obtained.

A value-based incentive structure is one way to avoid encouraging higher measure costs. The most common value-based custom incentive structure is one that pays a fixed amount per annual kWh saved, or peak kW saved, or both. It is also common to limit the incentive paid based on the IMC or project cost. The inclusion of a cost-based upper limit is not equivalent to a cost-based incentive structure.

A value-based incentive structure has both advantages and disadvantages compared to a cost-based approach. Cost-based approaches are better at encouraging comprehensiveness and may be better at minimizing free-ridership; however, the cost-based incentives have the disadvantage of rewarding, and thus encouraging, higher project costs in some situations.

Paying incentives based on resource value aligns the pricing signal with value of the competing resource. This alignment is likely to lead to a lower overall resource acquisition cost. The disadvantages with this approach include that it may offer incentives for measures that are higher than required to move the market and it does not effectively address various market transformation objectives. Value-based incentives can also lead to higher rates of “cream skimming” and less comprehensive energy efficient solutions.

One compelling advantage of the value-based incentive for some program administrators is that it automatically shifts “non-economic” project costs to the participants. This attribute significantly reduces the need for TRC screening thus assuring that the total resource benefit will be greater than the program cost and thus all program costs are spent in an economic manner.

An important condition of not conducting TRC project screening is ensuring that the participants have a clear understanding of the energy-related economics for their project. Participants will be persuaded against investing in projects with a TRC ratio less than 1.0 if the IMC have been estimated appropriately and if their perceived value of the non-energy benefits is not sufficient to achieve the required return on investment. The focus of program implementation activities can be shifted from screening projects to ensuring the potential participants are well informed about the energy-related economics of the proposed project.

Summary and Recommendations

The TRC test is a useful metric when used strategically and in combination with other metrics to assess the cost-benefit of various portfolio and program strategies. Reliance on the TRC alone without consideration of context may not be sufficient to ensure an optimal portfolio or program design.

The TRC test is also a useful screening tool to determine which measures should be eligible for prescriptive incentives. This screening works best when performed at a fairly aggregated level. Applying the TRC test at a disaggregated level can undermine the efficiency potential of a portfolio and could result in increased market barriers.

The use of the TRC screening for determining project eligibility is a common practice for many custom incentive programs to ensure that program funds are not paid to non-economic projects. However, TRC screening can undermine the potential of custom programs, because of program administration costs and increases in the participant's hassle and transaction costs.

An alternative to TRC project screening is to develop an incentive structure that effectively transfers the burden of all "non-economic" costs to the participants. The approach of leaving the decision to the participant is preferable given that the TRC perspective is limited to energy benefits and participants make investment decisions to achieve both energy-related and non-energy benefits.

The TRC test should be used to limit the incentive paid on projects in programs with cost-based incentive structures. For a project that does not pass the TRC test, this can be accomplished by determining the maximum IMC value that is needed to pass the TRC test. The incentive would be calculated using the maximum IMC value. This ensures that the program does not subsidize the non-energy investments, but still can support the project at a level commensurate with the value to the program.

TRC screening serves little purpose for programs with value-based incentives. The higher IMC costs are automatically shifted to the participant when incentives are paid based on the expected resource value. The participant's willingness to invest after being fully informed that the energy-related benefits do not justify the proposed investment simply suggests the participant placed a sufficiently high value on the other non-EE benefits. Since the participant is in the best position to allocate the project costs across the multiple benefits they expect to receive, the decision about whether the project is cost-effective should be left to the sufficiently-informed participant. Programs should still be able to pay a resource-based incentive to custom projects that produce energy savings a well as other non-energy benefits.

References

California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects, California Public Utilities Commission, October 2001. ftp://ftp.cpuc.ca.gov/puc/energy/electric/energy+efficiency/em+and+v/Std+Practice+Manual.doc.

EPA's National Action Plan for Energy Efficiency (NAPEE) Chapter 6: Energy Efficiency Best Practices. http://www.epa.gov/cleanenergy/energy-programs/napee/resources/action-plan.html