

Whose Perspective? The Impact of the Utility Cost Test

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ABSTRACT

As more states have adopted portfolio standards for energy efficiency, a majority have selected the Total Resource Cost Test (TRC) as the cost-effectiveness threshold utilities must meet. This trend, however, may be changing. In 2009, Utah altered course, and required all programs pass the Utility Cost Test (UCT), rather than the TRC. Similarly, in 2008 Michigan passed Public Act 295, adopting the UCT as the cost-effectiveness screening test. Each test reflects a different perspective, and, depending on that perspective, desired outcomes can differ dramatically. This study examines: the theory behind each test perspective; the rationale for adopting each test; and key outcomes, including achieved savings, overall cost-effectiveness, cost-per-kWh, and the diversity of program offerings. The paper also examines advantages lost when only one test is used in evaluating a program's worthiness, and a glimpse of energy-efficiency's future if more jurisdictions adopt the UCT over the TRC.

Overview

The California Standard Practice Manual (California Manual) serves as the general standard of cost-effectiveness analysis in the United States (CPUC 2001), offering guidelines for measuring the cost-effectiveness of utility-sponsored programs using the following five, defined tests:

- ***Total Resource Cost Test (TRC)***. Originally known as the All-Ratepayer Test, this test examines efficiency from the viewpoint of an entire service territory. This test compares the program benefits of avoided supply costs to costs for administering a program and the cost of upgrading equipment¹. When a program passes the TRC, this indicates total resource costs will drop, and the total cost of energy services for an average customer will fall.
- ***Ratepayer Impact Test (RIM)***. Originally known as the Non-Participant Test, RIM is also known as the "no losers test." The RIM tests from the viewpoint of a utility's customers as a whole, measuring distributional impacts of conservation programs. The test measures what happens to average price levels due to changes in utility revenues and operating costs caused by a program. A benefit/cost ratio less than 1.0 indicates the program will influence prices upward for all customers. For a program passing the TRC but failing the RIM, average prices will increase, resulting in higher energy service costs for customers not participating in the program.
- ***Utility Cost Test (UCT)***. Also known as the Program Administrator Test (PACT), this test measures cost-effectiveness from the viewpoint of the sponsoring utility or program administrator. If avoided supply costs exceed costs incurred by the program administrator, average costs decrease.
- ***Participant Test (PCT)***. This test measures benefits and costs to customers participating in

¹ Some states use a modified TRC which can include non-energy benefits or a lower discount rate more in line with the societal perspective; however the California Manual strictly defines the TRC as including benefits only from avoided energy costs.

demand-side management (DSM) programs. The test compares bill savings against incremental costs of the efficient equipment. It measures a program’s economic attractiveness to customers, and can be used to set rebate levels and forecast participation.

- **Societal Cost Test (SCT).** A variation of the TRC, this test expands the point-of-view from the service territory to society’s perspective. The TRC and the SCT differ in two important ways: 1) while the TRC uses an average cost of capital discount rate, the SCT uses a societal discount rate; and 2) the SCT also includes *all* quantifiable benefits attributable to a program, such as avoided pollutants, water savings, detergent savings, and other non-energy benefits.

A recent survey of U.S. cost-effectiveness requirements conducted by Cadmus indicates the TRC is the dominant cost-effectiveness test. Of 27 states reviewed for this study, 18 rely solely on the TRC or SCT. Three states review cost-effectiveness from multiple perspectives (including the UCT and TRC/SCT). Table 1 shows requirements by state. Jurisdictions clearly trend toward requiring the TRC when evaluating the economic worthiness of a measure, program, or portfolio of programs. Changes in multiple states confirm this trend: in Florida, which recently changed from using the RIM to the TRC; in New York, where the 2008 Energy Efficiency Portfolio Standards (EEPS) require all measures to pass the TRC (New York PSC 2008); and in Pennsylvania, where 2008 ACT 129 requires portfolios to pass the TRC (PA PUC 2009).

Table 1. Primary Cost-Effectiveness Test by State

All tests	TRC/SCT Primary Threshold	UCT Primary Threshold
IN, IA, NC	CA ² , CO, DE, FL, IL, ME, MA, MN, MO, NH, NJ, NM, NV, OH, OR ³ , PA, RI, VT, WA, WI	CA, CT, MI, OR, TX, UT

While the majority of jurisdictions use the TRC, a few notable exceptions point toward a newer trend of using the UCT. Utah relied on the TRC for a number of years, but replaced it with the UCT in 2009. Michigan, a state that adopted energy-efficiency standards in 2008 along with Pennsylvania and New York (TRC jurisdictions), prescribed the UCT as the cost-effectiveness threshold utilities must meet. California has also shifted to a weighted TRC and UCT test, rather than the TRC alone (CPUC 2005).

Before examining the rationale for selecting one test over the other, one must examine the differences between the two tests more closely. While similar, the UCT and the TRC differ significantly in calculating net benefits. The table below outlines costs and benefits associated with each test.

Table 2. Benefits and Costs for TRC and UCT⁴

	Total Resource	Utility
Benefits	<ul style="list-style-type: none"> • Utility avoided supply costs • Tax credits 	<ul style="list-style-type: none"> • Utility avoided supply costs
Costs	<ul style="list-style-type: none"> • Program administrator costs • Net participant costs 	<ul style="list-style-type: none"> • Program administrator costs • Incentives paid by sponsoring utility

² California uses a weighted UCT/TRC test.

³ Oregon relies on the TRC and UCT.

⁴ This summary, focusing on energy efficiency, does not include costs and benefits associated with fuel switching or demand response programs.

The two tests generally use the same benefits with the exception of measures where the rebate exceeds the incremental cost or where tax credits are available resulting in significant differences in cost-effectiveness. Differences between the two tests' results generally can be found in the costs. The TRC uses a measure's incremental cost, which can be thought of as the cost of upgrading installed equipment to a higher efficiency. In contrast, the UCT only uses the cost paid by the utility (generally as rebates to participating customers⁵).

While the California Manual cites the TRC's scope as a strength, given it captures all demand-side option costs, this can also be considered its weakness. A price impact perspective considers only costs incurred by the utility as relevant. While utilities typically incur total costs of supply-side options, demand-side options incur only program administration and incentive costs. Using the UCT accounts for this difference in accounting for supply- and demand-side costs.

As utilities generally pay the full cost for low-income weatherization or energy education programs, the TRC costs for such programs generally equal utility costs. For the majority of program offerings, however, the difference between TRC and UCT costs will differ substantially. Table 3 below illustrates differences between estimated incremental costs and standard rebates for select measures.

Table 3. Incremental and Rebate Cost Comparison⁶

Measure	Incremental Cost	Utility Incentive
High Efficiency Clothes Washer	\$258	\$50
Heat Pump Hot Water Heater	\$2,433	\$300
Tankless Water Heater	\$685	\$300
Energy Star [®] Refrigerator ⁷	\$30	\$50
CFL ⁸	\$4	\$2
Energy Star [®] Room Air Conditioner ⁷	\$50	\$25

Clearly, these costs substantially differ: clothes washers and heat pump water heaters exhibit incremental costs five times the utility cost; room air conditioners and refrigerators experience utility costs (incentives) exceeding the incremental cost.

While the rationale behind adopting the TRC or UCT may not always be clear, the use of the TRC appears to be driven by a concern for appropriate use of ratepayer funds. In Pennsylvania, for example, the portfolio of programs must pass the TRC because “[a] B/C ratio above one indicates that the program is beneficial to the utility and its ratepayers on a total resource cost basis.” (Pennsylvania PUC 2009). In Pennsylvania, not only must the utility realize a benefit from energy-efficiency activities, but ratepayers must benefit as a whole. New York shares similar concerns regarding use of ratepayer funds, requiring all measures, projects, and programs to pass the TRC (New York PSC 2009).

In Utah, the UCT has been adopted as the primary cost-effectiveness measure “[t]o put candidate demand-side resources on the same footing as supply-side resources.” (State of Utah 2009). While utilities must provide all five tests outlined in the California Manual for filed programs, the UCT serves as the primary test in screening programs⁹. As seen in the costs outlined above, impacts of adopting the

⁵ Utility costs include administrative costs, which are also accounted for in the TRC costs.

⁶ Sources for incremental costs are provided in Table 8 unless otherwise noted.

⁷ Incremental cost from Energy Star[®]

⁸ Incremental costs from engineering research.

⁹ Note that, while the Commission requires utilities to provide the PCT and the Division of Public Utilities cites its usefulness in program design, the Division states the PCT “should be accorded little weight in the approval of DSM programs.” (Utah

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UCT over the TRC have the potential to dramatically increase potential savings. The Utah Office of Consumer Services notes: “the practical effect is that more DSM resources will likely be selected as cost-effective in future IRP case scenarios.” (State of Utah 2009).

While California traditionally has used the TRC test, the California Public Utility Commission (CPUC) has recognized DSM costs differ from those associated with supply-side options. Noting TRC costs more accurately capture comparisons between supply-side and demand-side costs, the CPUC adopted a “two thirds TRC to one-third [UCT] weighting in calculating the performance basis of energy efficiency resource programs.” Incorporating the UCT seeks to minimize utility administration costs, while balancing comparisons to supply-side resources.

The Impact

To better examine differences in applying the TRC versus the UCT, we examine cost-effectiveness results reported by three utilities for selected residential energy-efficiency programs.

Table 4. Appliance Rebates: Comparison of Cost-Effectiveness

Utility	TRC	UCT	PCT	RIM
MidAmerican (Iowa) ¹⁰	1.45	3.60	2.82	0.70
Questar ¹¹	1.90	2.80	2.20	1.90
DTE ¹²	4.77	9.59	7.75	0.77

As shown in Table 4, the appliance rebate program passes the TRC for each utility. MidAmerican finds it marginally cost-effective from a TRC perspective. The program, however, evidences a very high benefit-cost ratio for the UCT. While benefitting ratepayers, this program is clearly cost-effective for utilities. It also passes the PCT for all three utilities, indicating that it will be economically attractive to customers. Based on experiences with other, similar programs, we know such offerings generally prove popular, and serve many customers. Balancing the TRC, UCT, and the program’s value, this program can clearly be considered worthy of funding.

Table 5. New Construction: Comparison of Cost-Effectiveness

Utility	TRC	UCT	PCT	RIM
MidAmerican (Iowa)	1.06	2.27	1.67	0.78
Questar	1.60	2.60	2.30	1.70
DTE	0.30	1.64	0.42	0.63

As shown in Table 5, the new construction program does not pass the TRC for the electric-only utility (DTE), and is marginally cost-effective for MidAmerican, which includes costs and benefits for both gas and electric. The program indicates the greatest cost-effectiveness from a TRC perspective for Questar, a gas utility. The UCT, however, passes in all cases. For such programs, examining the PCT for as an indicator of non-energy benefits can be worthwhile. Customers commonly participate in programs or adopt measures that do not pass the PCT or TRC. Recently, it has been suggested this indicates customers may be motivated by factors other than energy savings, and costs used in the TRC or PCT are not necessarily directly tied to the energy benefits, thus biasing the tests (Neme 2010). This argument

Division of Public Utilities, 2009)

¹⁰ Gas and electric rebates.

¹¹ Gas rebates only

¹² Electric rebates only

proves particularly persuasive for a new construction program, where customers participate even though the economics suggest they are making an economically irrational decision. Program experience and economic analysis tell us these tests might not accurately reflect reality. As customers do participate in this program, costs have been overstated or not all benefits perceived by participants have been accurately captured. While it is important to calculate the TRC, in this instance, the PCT and industry experience indicate the UCT might more accurately reflect the economics and behavior.

Though commonly acknowledged as difficult to reach, the multifamily market offers significant savings, making it important to offer programs to this sector. Table 6 illustrates this program does not pass the TRC for MidAmerican, and only marginally passes for Questar. It is better in this instance to rely on the UCT in the case of Questar where the program is substantially more cost-effective from a utility perspective. For MidAmerican, it is important to balance cost-effectiveness requirements, equitably serving ratepayers and, possibly, the need for hard-to-reach markets in achieving savings targets.

Table 6. Multifamily: Comparison of Cost-Effectiveness

Utility	TRC	UCT	PCT	RIM
MidAmerican (Iowa)	0.96	0.99	34.78	0.48
Questar	1.20	2.40	1.60	0.40
DTE	2.70	4.05	9.85	0.68

To achieve a more granular view, we examine the cost-effectiveness of select energy-efficiency measures. Table 7 shows the inputs and results of cost-effectiveness analysis for six measures. Table 8 provides the sources for these inputs.

Table 7. Measure Cost-Effectiveness Comparison

Measure	High Efficiency Clothes Washer (Gas / Electric)	Heat Pump Water Heater	Tankless Water Heater	High Efficiency Dishwasher	Air Source Heat Pump (14.5 SEER)	LED (6 W)
Savings	224 (kWh) 6 (therms)	1,622 (kWh)	55 (therms)	74 (kWh)	2,691 (kWh)	33 (kWh)
Measure Life	11 years	10 years	20 years	10 years	12 years	24 years
Incremental Cost	\$258	\$2,433	\$685	\$12	\$1,000	\$25
Rebate	\$50	\$300	\$300	\$20	\$250	\$8
TRC	0.38 / 0.10	0.27	0.48	2.52	1.24	0.87
UCT	2.35 / 0.64	2.63	1.49	1.80	6.06	3.79
PCT	0.77 / 0.37	0.55	1.24	5.57	2.14	1.58

Table 8. Cost-Effectiveness Assumptions¹³

Measure	High Efficiency Clothes Washer	Heat Pump Water Heater	Tankless Water Heater	High Efficiency Dishwasher	Air Source Heat Pump (14.5 SEER)	LED (6 W)
Savings	Energy Star®	PA TRM ¹⁴	NY TRM	Energy Star®	Energy Star®	Engineering Calculation
Measure Life	Energy Star®	PA TRM	NY TRM	Energy Star®	Energy Star®	DEER ¹⁵
Incremental Cost	Energy Star®	RTF ¹⁶ and research	Research	Energy Star®	Energy Star®	Online pricing

¹³ The analysis used a TRC and UCT discount rate of 7.7% and a PCT discount rate of 10%.

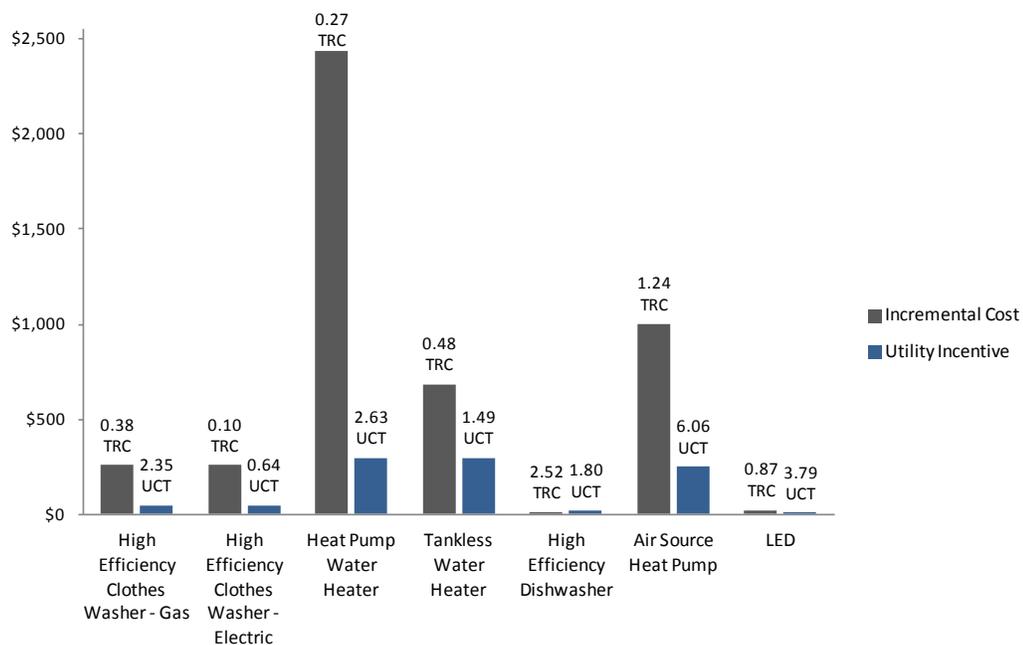
¹⁴ Pennsylvania Public Utility Commission Technical Reference Manual.

¹⁵ Database for Energy Efficient Resources.

Measure	High Efficiency Clothes Washer	Heat Pump Water Heater	Tankless Water Heater	High Efficiency Dishwasher	Air Source Heat Pump (14.5 SEER)	LED (6 W)
Avoided Cost	Annual Energy Outlook					
Retail Rates	Energy Star®					

The results of this analysis are also presented in Figure 1, which shows the dollar value of each measure's incremental cost in the first bar and the utility incentive in the second bar. The bar representing the incremental cost is labeled with the corresponding TRC ratio, while the bar representing the incentive shows the corresponding UCT ratio (as these are the two major cost components that vary between the tests). This illustration highlights the relationship between incremental costs and the TRC and utility incentives and the UCT.

Figure 1. Incremental Cost vs. Utility Incentive by Measure



Though water heating measures (save dishwashers) do not prove cost-effective from a TRC perspective, each measure passes the UCT, and only the tankless water heater and dishwasher pass the PCT. While the air source heat pump passes the TRC, it does so marginally, and has a high benefit-to-cost ratio for the UCT. This illustrates more specifically how relying on the UCT can expand program offerings and potential savings, but use of the TRC and PCT can assist in carefully assessing these measures for program inclusion, setting rebate levels, and forecasting participation.

Table 7 also indicates the LED measure fails the TRC, but passes the UCT and PCT. Due to high freeridership rates and changing baselines associated with CFLs, LEDs merit careful consideration for their ability to help meet long-term savings goals. Further, this illustrates a situation where funding a measure could increase market adoption rates and reduce costs over time. The TRC does not include benefits from such market impacts, again illustrating the advantages of carefully considering the other tests' results.

¹⁶ Regional Technical Forum.

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Beyond examining individual programs and measures, we examine whether or not overall program offerings vary between jurisdictions relying on the TRC or UCT. Table 9 compares offerings that target hard-to-reach customers and typically do not prove cost-effective from a TRC perspective.

Table 9. Residential Program Offerings¹⁷

State	Test	Multifamily Directly Targeted	Direct-Install
Florida	TRC	No	No
New York	TRC	Yes	Yes
Pennsylvania	TRC	Yes ¹⁸	Yes
California	TRC/UCT	Yes	No
Oregon	TRC & UCT	Yes	Yes
Connecticut	UCT	Yes	No
Michigan	UCT	Yes	Yes
Texas	UCT	Yes	No ¹⁹
Utah	UCT	No	No

Table 10 compares offerings in the commercial and industrial (C&I) market.

Table 10. Commercial and Industrial Program Offerings¹⁷

State	Test	Direct-Install	Small Businesses Directly Targeted	Government/ Nonprofits Directly Targeted	On-Bill Financing or Energy Grants
Florida	TRC	No	No	Yes	No
New York	TRC	Yes ²⁰		No	No
Pennsylvania	TRC	Yes	Yes	Yes	No
California	TRC/UCT	No	No	No	No
Oregon	TRC & UCT	No	No	Yes	No
Connecticut	UCT	No	Yes	No	Yes
Michigan	UCT	No	No	No	No
Texas	UCT	No ²¹	Yes	Yes	Yes
Utah	UCT	No	No	No	No

Comparing general offerings, Table 11 shows that jurisdictions relying on the UCT have the edge in offering financing, education, and innovative technology program. The differences, however, are slight.

Table 11. General Offerings¹⁷

State	Test	Financing Options	Market Transformation, Innovative Technologies, or Pilot Programs	Education Programs
Florida	TRC	No	Yes ²²	No
New York	TRC	No	Yes	Yes ²³

¹⁷ This analysis examines utility offerings only.

¹⁸ The FirstEnergy companies of Pennsylvania (Penelec, Met-Ed, and Penn Power) are the only Pennsylvania utilities offering multifamily programs. PECO, which includes Philadelphia in its service territory, does not offer a targeted multifamily program. The other Pennsylvania utilities indicate limited potential savings in this market.

¹⁹ Texas' residential standard offer program allows contractors to submit applications for energy-efficiency projects, which could include direct installation by a contractor. Texas utilities, however, do not offer standalone, direct-install programs.

²⁰ The Small Business Direct-Install "Fast Track" programs directly target small business.

²¹ Note previous reference to Texas' residential programs.

²² Florida Power and Light offers an Energy Innovation program funding innovative projects in the C&I sector.

²³ This state claims savings associated with education programs.

State	Test	Financing Options	Market Transformation, Innovative Technologies, or Pilot Programs	Education Programs
Pennsylvania	TRC	No	No	Yes
California	TRC/UCT	Yes	No	No
Oregon	TRC & UCT	No	Yes	Yes
Connecticut	UCT	Yes	Yes	No
Michigan	UCT	No	Yes	Yes
Texas	UCT	Yes	Yes	Yes
Utah	UCT	No	No	No

Overall trends point to greater differences between individual programs or measures rather than in overall offerings. Programs targeting government or non-profits are more frequently intended to meet savings targets and regulatory requirements rather than designed based on cost-effectiveness screening. It is important to note that only Texas, Connecticut, and California, all states that rely on the UCT, offer financing options.

Conclusion

While many states require utilities to report more than a single cost-effectiveness test for DSM, a single test can generally be relied on in determining an energy-efficiency program or measure's worthiness. Most jurisdictions use the TRC, but there are increasingly more jurisdictions that rely on the UCT (or, in the case of California, combine the two). After examining impacts from relying on a single test, we advocate using a more nuanced approach for screening DSM programs, specifically recommending the following guidelines:

- 1) ***Test the DSM program using the TRC to provide a cost comparison with supply-side resources.*** While there are ongoing discussions regarding the appropriate application of the TRC, the TRC is beneficial in that it accurately measures total costs of implementing a demand-side alternative, though consumer demand clearly indicates benefits captured in the TRC may not be comprehensive.
- 2) ***Rely on the UCT as the threshold test for program approval and cost recovery.*** The UCT accurately compares the utility (and, therefore, utility customer) costs with supply-side alternatives. Consequently, total costs to the utility are minimized for a UCT greater than 1.0. Customer participation will indicate whether, from the customer's perspective, participation benefits exceed the costs.

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