

**CHAPTER 9: Program screening****Overview of cost-effectiveness tests**

Cost-effectiveness screening is a critical part of the energy efficiency program planning process and there are well-established methodologies for conducting cost-effectiveness analysis. The [California Standard Practice Manual](#) is used by California utilities and regulators, and is frequently cited by regulatory bodies in other states. This publicly-available reference describes in detail the primary approaches used for evaluating the cost-effectiveness of demand-side management activities.

Though there are several different tests that evaluate cost-effectiveness from a variety of perspectives, all of them compare the net present value of the benefits of the energy efficiency resource (lifetime savings) with the net present value of the cost of the energy efficiency resource. Results are typically expressed as a benefit-cost ratio or as the net present value of benefits (NPV benefits - NPV costs).

- **Total Resource Cost Test (TRC):** This test compares benefits to society as a whole (avoided supply-side cost benefits, additional resource savings benefits) with the participant's cost of installing the measure plus the cost of energy efficiency program administration (non-incentive costs). Incentives are considered a transfer payment from program to participant and thus are not explicitly accounted for in the calculation. Since the TRC test takes a societal perspective into account, it is the appropriate test for regulatory agencies and other policymakers to use in establishing energy conservation goals.
- **Societal Cost Test (SCT):** The SCT is similar to the TRC, except the SCT explicitly quantifies externality benefits such as avoided pollutant emissions not represented in market prices and other non-energy benefits (e.g., improved health/productivity).
- **Program Administrator Cost Test (PAC):** Sometimes referred to as the utility cost test, this test compares the utility's avoided cost benefits with energy efficiency program expenditures (incentives plus administrative costs). Along with the TRC test, the PAC test is one of the most commonly-used tests for energy efficiency program planning purposes. It is also frequently used in a resource planning context to evaluate energy efficiency investments against supply-side alternatives.
- **Participant Cost Test (PCT):** This test compares participant benefits (incentives plus bill savings) with participant costs (incremental or capital cost, installation, O&M, etc.).
- **Rate Impact Measure Test (RIM):** This test compares the utility's avoided cost benefits with the cost of administering energy efficiency programs plus lost revenue from reductions in customer energy consumption. The RIM test is a distributional test that is best-suited for assessing the equity (fairness) impacts of energy efficiency programs.

The following table, published in the National Action Plan for Energy Efficiency guide [Understanding the Cost-Effectiveness of Energy Efficiency Programs](#), shows the costs and benefits that are included in each test.

COMPONENT	PCT	PAC	RIM	TRC	SCT
Energy- and capacity-related avoided costs	Benefit	Benefit	Benefit	Benefit	Benefit
Additional resource savings (e.g., water, secondary fuel)				Benefit	Benefit
Non-energy benefits (externality)					Benefit
Equipment (incremental or capital) and installation costs	Cost			Cost	Cost
Program overhead (administrative) costs		Cost	Cost	Cost	Cost
Incentive payments	Benefit	Cost	Cost		
Bill savings	Benefit		Cost		

SOURCE: National Action Plan For Energy Efficiency

## Cost-effectiveness model

The Energy Center of Wisconsin has developed a simple spreadsheet model for evaluating program cost-effectiveness. This model has been set up to run the Participant Cost Test, the Program Administrator Test, and the Total Resource Cost test for three sample programs: residential lighting and appliance incentives; residential audit and direct installation; and prescriptive rebates for C&I customers. Utilities may download this simple tool and modify it as needed to meet program planning objectives. Cells containing input assumptions are highlighted in yellow and should be modified to reflect utility-specific conditions. Calculation cells are highlighted in blue. Additional measures and programs can be added using this format.



Cost-effectiveness model spreadsheet.

## Application of cost-effectiveness analysis

Cost-effectiveness can be assessed at the measure level, at the project level, at the program level, or at the portfolio level. While the program planner is primarily interested in evaluating cost-effectiveness at the program and portfolio levels, there are several important considerations to keep in mind.

When screening cost-effectiveness at the measure level, the benefit-cost ratio represents the **average** cost-effectiveness of that measure across all potential applications. A measure that has an average benefit-cost ratio of 0.75 could potentially achieve a benefit-cost ratio of 1.50 in some applications, and a benefit-cost ratio of 0.25 in other applications. Consider, for example, a high-efficiency HVAC system that would be cost-effective if installed in a large, leaky home, but would not be cost-effective if installed in a small, air-tight home. Understanding this issue is particularly important when it comes to evaluating energy efficiency projects for large commercial and industrial facilities, where cost-effectiveness can vary widely depending on site-specific characteristics.

Another important consideration is that some measures may not be cost-effective if assessed on an individual basis, but would be cost-effective if bundled with other measures. For example, weatherstripping may have a benefit-cost ratio below 1.0 if evaluated by itself, but a bundle of weatherization measures that includes weatherstripping could pass the cost-effectiveness screen if implemented as a package. Bundling multiple measures into a single program delivery mechanism is one strategy for reducing lost opportunities.

Finally, while cost-effectiveness analysis indicates which energy efficiency resources represent a prudent use of energy efficiency program dollars, it does not indicate the magnitude of the savings opportunity. A measure with a high benefit-cost ratio could represent a small amount of potential savings, while another measure that is marginally cost-effective could represent an area of significant savings potential. In that case, the marginally cost-effective measure could represent a better target for energy efficiency program resources. Ranking all cost-effective measures by amount of potential savings rather than by benefit-cost ratio would be a preferable approach for determining which measures to target with energy efficiency programs.

## Additional considerations

There are several key areas where input assumptions have a significant effect on cost-effectiveness analysis results: avoided costs; valuation of avoided externality costs (such as sulfur dioxide, oxides of nitrogen, and mercury); and discount rates.

Avoided costs are the primary basis for valuing energy efficiency resource benefits, and there are important policy implications inherent in determining the appropriate avoided cost values to use. Some utilities use forecasted prices for wholesale power purchases, others use estimated costs of new supply-side generation resources. It is also important to account for avoided transmission and distribution costs. If a utility's primary objective is reducing carbon emissions, the appropriate supply-side benchmark could be the cost of a clean energy source such as wind power.





Valuation of avoided externality costs is a component of the TRC and SCT tests. As utilities seek strategies for mitigating climate risk, a growing number are incorporating the value of avoided carbon emissions into cost-effectiveness analysis. Given that there is not yet a national policy framework for regulating carbon emissions, there are inherent uncertainties involved in forecasting carbon prices into the future. However, recent studies by Synapse Energy Economics and EcoSecurities Consulting Ltd. have forecasted prices between \$10 and \$50 per metric ton of carbon equivalent. The [EcoSecurities study](#) commissioned by the Northwest Power Coordinating Council is publicly available and presents ranges for carbon prices under alternative policy scenarios. Information about an individual utility's generating mix is necessary to convert prices per metric ton to a \$/ kWh basis. If utility-specific emissions factors are not known, EPA's [Emissions & Generation Resource Integrated Database \(eGRID\)](#) provides regional emissions factors based on a comprehensive inventory of the environmental attributes of electric power systems.

Discount rates are used to determine the present value of future energy savings. The appropriate discount rate to use depends on the perspective from which cost-effectiveness is evaluated. From the participant perspective, the appropriate discount rate would be the consumer lending rate—the interest rate a customer would have to pay if they financed the energy efficiency investment. From a utility perspective, the appropriate discount rate would be the utility's weighted average cost of capital, or the interest rate paid in financing supply-side investments. Public policy decisions are made from a societal perspective, and thus typically employ a lower discount rate to appropriately value long-term societal benefits that result from energy efficiency investments made today.

Finally, it is important to be aware of state-specific requirements that utilities must follow in conducting cost-effectiveness analysis. For example, the Iowa Utilities Board defines the cost-effectiveness tests that utilities should use, and specifies an "externality adder" that must be included in the calculation of benefits. It is important to determine whether any such requirements apply to your calculations.

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## Resources

- [Cost-effectiveness model](#) 
- California Public Utilities Commission: [California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects](#) 
- EcoSecurities Consulting Ltd.: [GHG Market Forecasting Services: Assigning Carbon Price Estimates to Alternative Policy Scenarios](#). A Report for NWPPCC. 
- National Action Plan for Energy Efficiency: [Understanding the Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers](#) 
- National Action Plan for Energy Efficiency: [Guide to Resource Planning with Energy Efficiency](#) 

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