HOT WATER
INNOVATION PRIZE

Supplemental Guidance on Cost-Effectiveness

Guidebook & Rules Version 2.0

Prepared by the Northwest Energy Efficiency Alliance
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This document is considered part of the Hot Water Innovation Prize documents for Version 2.0 of the Contest *Guidebook and Rules*.

Please see https://partners.hotwatersolutionsnw.org/hot-water-innovation-prize for current Contest status and updates.

1. Introduction

The Northwest Energy Efficiency Alliance (NEEA) is pleased to present this *Supplemental Cost-effectiveness Guidance* for the Hot Water Innovation Prize (Contest) *Guidebook and Rules Version 2.0* to interested Participants. A core objective of the Contest is to encourage the development of products that utilities and other incentive program implementers can include in their energy efficiency incentive programs. Cost-effectiveness analysis is a fundamental step in designing and evaluating these programs. This document provides general guidance on how utilities might consider the cost effectiveness of a split system heat pump water heater (HPWH) incentive program.

Please note that the example provided herein is instructive. NEEA does not recommend a specific incremental cost.

All Contest documents are available on the Contest website (partners.hotwatersolutionsnw.org/hot-water-innovation-prize). Please direct any questions to Contest Administrator Suzanne Foster Porter at InnovationPrize@hotwatersolutionsnw.org or 970.312.7179.

1.1 What is Cost Effectiveness?

Cost effectiveness is a methodology that policymakers, regulators, utilities, and others use to evaluate which investments provide the highest value for the associated cost. In energy efficiency, the reduction of energy use and its assigned benefits are the value. The associated cost is the incremental expense of the more efficient technology relative to the incumbent plus any added implementation expenditure (e.g., higher installation cost). Cost effectiveness evaluation enables stakeholders to prioritize investments in various energy-saving products and technologies. Utilities rely on cost-effectiveness tests to determine where they provide incentives and focus program efforts. For some utilities and other incentive program implementors, each individual technology must be cost-effective. Other incentive programs examine the average cost-effectiveness of a whole portfolio of technologies, with some above and some below a cost-effectiveness target.

1.2 How is it Calculated?

Utilities, regulators, or other interested parties calculate an intervention's cost effectiveness by considering many factors related to the efficiency gains. These may include, but are not limited to:

- the incremental cost of the product,
- the incremental cost of the installation,
- other added costs compared to the incumbent technology,
- the value of the electricity saved, and
- the avoided cost of carbon.

Such metrics can differ widely across the country, and the calculation methodologies employed vary. For more background on utility cost effectiveness, please see US DOE's Better Buildings Energy Efficiency Cost-Effectiveness Tool (v 2.0) Frequently Asked Questions (2017).[1]

1.3 Cost Effectiveness in this Contest

Incremental product and installation costs are significant variables in all cost-effectiveness calculations, and NEEA designed the Contest with this in mind. The Contest aims to encourage highly cost-effective split system HPWHs in the marketplace by encouraging Participants to bring an affordable heat pump water heater to market that is simple and inexpensive to install. Manufacturers do not influence energy pricing or how regions value emission reductions. Still, they can effectively position products for utility incentives by delivering split system HPWH with lower product and installation costs.

2. Northwest Cost Effectiveness Example

This example is not a benchmark incremental cost for the Contest. It has not been reviewed nor endorsed by the Northwest Power and Conservation Council (Council) or the Regional Technical Forum (RTF). This example only illustrates one cost effectiveness method used in the Northwest.

In the Northwest, the Council's RTF uses the ProCost model to evaluate the cost effectiveness of conservation opportunities (measures), using assumptions of the Council's current Power Plan.[2] The Northwest region is unique in that demand-side efficiency opportunities are also compared with supply-side new energy production development. ProCost is a public resource available for extensive review and use by any interested party.[3]

The ProCost model considers many factors, including:

- the cost of avoided electricity use,
- the CO_2 emissions per kWh,
- the avoided cost of CO_2, and

[1]Energy and Environmental Economics (E3) and Lawrence Berkeley National Laboratory. 2017. *Better Buildings Energy Efficiency Cost-Effectiveness Tool (v2.0) Frequently Asked Questions*. Prepared for DOE Better Buildings program. https://www.energy.gov/sites/prod/files/2017/03/f34/bbrp_ee_ce_tool-faqs_2017.pdf.

[2] Regional Technical Forum(RTF). 2024 ProCost. 18 September. https://rtf.nwcouncil.org/work-products/supporting-documents/procost/.

[3] Ibid.

- the expected time of day of the energy savings compared to the regional energy demand.[4]

The essential variables differ depending on the energy savings opportunity under consideration. For split system HPWH, the incremental cost and the Electric Regional Benefit Cost Ratio (B/C ratio) are the most important. Incremental capital cost includes the added costs for the product, its installation, and any other costs relative to the incumbent. The B/C ratio is the output of the ProCost model. The higher the B/C ratio, the better the cost effectiveness score.

The ProCost model uses NEEA's Advanced Water Heating Specification (AWHS) tiers. As the products specified in the Contest—split system HPWHs ≤ 35- gallons with low and very-low draw patterns—are not yet in the ProCost model, NEEA identified the most similar product: ≤ 55-gallon (AWHS) Tier 2 HPWH in an existing construction application.[5] The minimum seasonal coefficient of performance (SCOP) for the Contest is 2.4, which aligns with the minimum SCOP requirement for a Tier 2 split system HPWH in the AWHS.

Figure 1 illustrates the calculated B/C ratio with a range of incremental capital costs. Please note that the incremental capital cost shown in Figure 1 includes the incremental product and installation costs above the incumbent electric resistance technology.

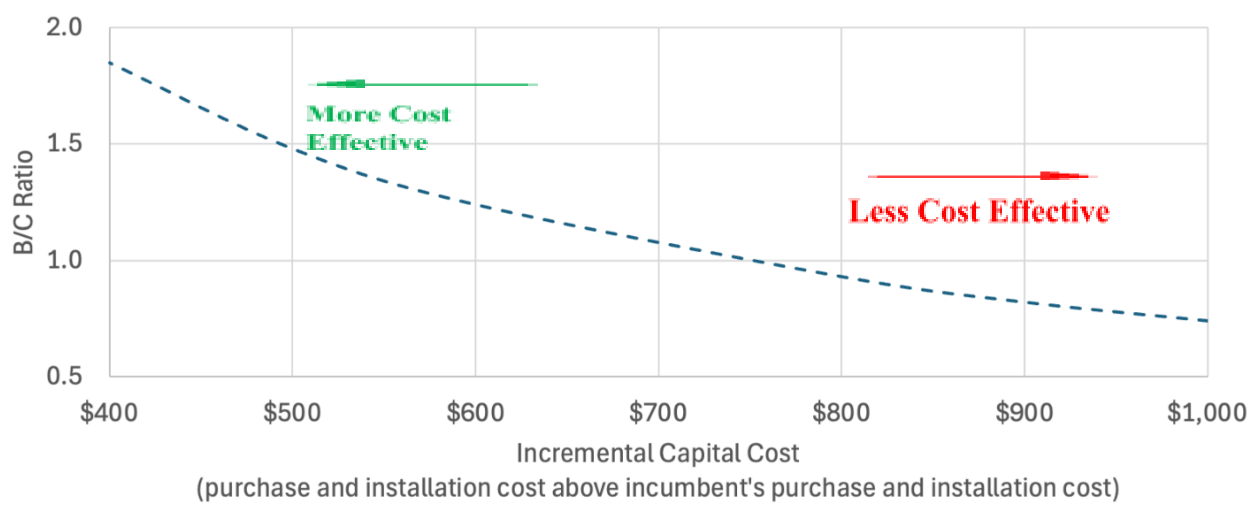

Figure 1: ProCost calculation of B/C ratio at various incremental capital costs for a Tier 2 HPWH (≤ 55-gallon) in existing construction.

[4] RTF. 2024. Users Guide for ProCost Version 5. https://nwcouncil.app.box.com/v/Procostuserguidev5-10.
[5] NEEA. 2024. *Advanced Water Heating Specification Version 8.1.* https://neea.org/img/documents/Advanced-Water-Heating-Specification.pdf.

Costs and benefits are equal when the B/C ratio is 1.0. Lower than 1.0, the costs exceed the benefits, possibly making implementation of utility incentive programs more challenging. A more favorable situation for utility programs is when the B/C ratio is higher than 1.0, where the benefits exceed the incremental capital cost. This analysis suggests that the cost effectiveness threshold for a split system HPWH with a SCOP of 2.4 is at an incremental capital cost of approximately $750 (B/C ratio of 1.0). A split system HPWH with a higher SCOP and more energy savings may be cost effective with even higher incremental capital costs.

As a reminder, this example is illustrative only. The Contest Administrators do not specifically recommend a $750 incremental capital cost for the products developed in this Contest. Higher or lower incremental capital costs may enable utilities and other program implementers to include split system HPHW in incentive programs, as discussed in Section 1.1.