



**Energy Trust of Oregon
New Buildings Program**

**Custom Track Technical
Guidelines**

Ver. 4 032510

Energy Trust of Oregon's New Buildings program provides assistance to project owners, architects, engineers, contractors and others involved in commercial and industrial new construction and major renovation projects. Projects in which energy efficiency measures are planned to be installed may be eligible for cash incentives and technical assistance.

The program has several tracks through which owners may participate, including Standard Track, Custom Track, LEED® Track, and ENERGY STAR® Track. A full description of the programs and Participant Manuals are available online at www.energytrust.org/newbuildings.

These *Custom Track Technical Guidelines* describe the technical requirements that projects enrolled in the Custom Track must meet. The projects will be examined to determine whether or not they are eligible for the program's incentives. The Custom Track provides cash incentives for the installation of building systems that are more energy efficient than those installed to meet minimum Oregon energy code requirements/standards in the same type building with similar occupancy.

Any measure that contributes to reducing the overall energy consumption of the proposed design over that of a baseline building can be considered an Energy Conservation Measure (ECM). These items are typically related to the envelope, mechanical, electrical, lighting, and building controls systems.

The project's energy consultant must estimate first-year annual electric and gas savings of the ECMs through an energy model or other energy analysis, as described in these guidelines. The energy consultant shall recommend ECMs to the design team that will pass the program's Cost-Effectiveness Calculator test (see Section 5) and have a simple payback period greater than one year. The consultant shall then describe the analysis in an Energy Analysis Report which is reviewed by the New Buildings program. Incentives are awarded to the project owner based upon program-approved energy savings calculations and successful installation of the measures.

By submitting the analysis to the program, the consultant is representing that he/she has read and understands these *Custom Track Technical Guidelines*; the submitted analysis is, to the best of his/her knowledge, truthful and accurate and has been performed in accordance with the Guidelines; and that he/she has been duly authorized by the named project owner to submit the Energy Analysis Report to the program on the project owner's behalf.

This process is described in detail in these guidelines, in the following sections:

- Section 2 – Analysis Guidelines
- Section 3 – Energy Analysis and Documentation
- Section 4 – Energy Analysis Report
- Section 5 – Benefit-Cost Ratio Test

2.1 STATE SPECIFIC CODE REQUIREMENTS

Chapter 13 of the Oregon Structural Specialty Code (OSSC) establishes the minimum energy efficiency and system requirements for the state of Oregon.

In instances where a project is exempt from Oregon code compliance or no code requirement is specified, the program will accept common industry practice or relevant ASHRAE standards to establish the baseline.

2.2 ENERGY ANALYSIS SELECTION

No specific analytical approach is required or prescribed. Custom spreadsheets, building energy simulation models, manufacturer's calculator tools, and other analyses recognized as standard engineering practice are acceptable. The analysis should reflect good engineering practice with a level of effort consistent with the complexity of the measures being considered. An Energy Analysis Report will be required as part of the *Custom Track* and is discussed in Section 4.

The details and requirements of the energy simulation and spreadsheet calculation methodologies are provided below.

2.2.1 Spreadsheet and Manual Calculations

An energy analysis using spreadsheet or manual calculations shall be performed in a manner that is clear and concise, and uses industry accepted methodologies. The consultant shall clearly identify all assumptions, constants, and equations used in their calculation. Weather dependent measures, such as outside air economizer measure, should be modeled using an hourly or bin-based approach utilizing relevant data from the closest weather station so that site specific operating conditions are captured in the savings estimate.

The energy savings of each ECM is determined by subtracting the proposed annual energy consumption from the annual energy consumption of the corresponding baseline.

The baseline for each ECM shall meet the requirements of Chapter 13 of the OSSC unless the project is exempt or no code applies (see Section 2.1).

Specific details (e.g. equipment and motor efficiencies, operating schedules, fan speed percentages) for each ECM and the corresponding baseline information shall be clearly identified and used in the energy consumption calculations. The expected utility service provider and corresponding rate schedule shall be clearly identified, and these values shall be used in the energy cost savings calculations for each measure.

2.2.2 Energy Simulation Modeling

Since there are limitations in the accuracy of modeling some ECMs with building energy simulation software, it is up to the energy consultant to choose a program that is appropriate for the anticipated ECMs. The energy consultant shall model the facility using Oregon's *State*

Energy Efficiency Design (SEED) program's Building Modeling Guidelines Appendix L¹. All energy simulation models shall conform to SEED Appendix L guidelines regardless of whether or not they are SEED projects.

The building energy simulation program for each project shall be consistent with the "Simulation General Requirements" indicated in Section 2 of SEED Appendix L. **The version of the simulation modeling program used shall be the latest version available on the date that the Program sends the participant notice that the Program has received the project's Project Enrollment: Form 510E and the project has been enrolled in the program.**

If the selected energy simulation program cannot explicitly model an ECM, the consultant may utilize a thermodynamically similar component model that can approximate the expected performance. Consultants have the flexibility to utilize industry accepted methodologies where such deficiencies in the model will not accurately qualify savings.

All whole building energy simulation models shall calculate the baseline and proposed building performance using the requirements of SEED Appendix L.

The program does not require:

- Implementation of "Baseline" ECMs as discussed in SEED Appendix I.
- Monitoring and verification as mandated by SEED.

2.2.2.1 Baseline

Projects that only propose measures which aim to achieve Custom Track incentives shall model the baseline, such that it meets the minimum requirements of Chapter 13 of the OSSC.

The baseline HVAC system type should be selected in accordance with SEED Appendix L. In some instances the baseline selection may not be appropriate for the facility type and use, and may not represent a system type that is representative of best or industry practice. In such instances the consultant should contact the Program to discuss the baseline system selection.

Alternatively, the Program may request the consultant to choose an alternative baseline HVAC system type that best represents industry standard practice.

For projects proposing measures that aim to achieve a combination of *Custom* and *Standard Track* incentives, both the baseline and proposed models shall be modeled with the proposed *Standard Track* measure(s). Both models must incorporate the performance requirements and characteristics of the respective *Standard Track* measure(s) rather than the corresponding minimum code requirement(s).

For projects where the OSSC does not apply, common industry standard practice shall be used in the baseline model. In instances where a code official has modified the specific requirements of the OSSC for a specific building (ie. historically significant building), such modifications shall be identified and substantiated in writing to the program and noted in the energy analysis report.

¹ It should be noted that SEED Appendix L was developed from ASHRAE 90.1 Appendix G and contains modifications and enhancements to comply with the intent of the Oregon Structural Specialty Code Chapter 13

These strategies provide a consistent benchmark against which to compare energy performance metrics, energy savings measures, and energy strategy alternatives. For projects with unique circumstances, in which savings cannot be realistically calculated as described above, contact the New Buildings program.

2.2.2.2 Model Interactive Effects

The following three approaches are acceptable for energy simulation modeling in determining measure savings:

Subtractive baseline: The as-designed building is run with all measures included. One measure is removed and the model is rerun. That measure is put back into the model and another is removed and the model is run again. This is done until all measures have been evaluated. The difference between the total interactive run values and the values determined when the measure is removed is considered the individual measure's contribution. These values are used in the Cost-Effectiveness Calculator (CEC) test tool.

This is the most conservative approach for ascertaining the effect of individual measures.

Incremental or rolling baseline: The measures to be included in the design are added one at a time to the model and a run made for each to estimate the effect of the individual measure. It is possible the sum of the savings will equal the total for the interactive model.

This is a more expensive approach and if a measure is removed or modified the model will have to be rebuilt from the point where that element was added to the model. It is less conservative than the subtractive approach in measuring the effect of individual measures due to the fact that they are not tested against the background of the rest of the measures.

Individual approach: The measures are tested one at a time in isolation against the baseline. Selected measures are included in the final, interactive model. This is the least conservative approach to estimating the effect of individual measures in the final building design. The Individual approach does not result in an interactive model that includes all the ECMs.

It is a requirement of the Program that, regardless of the modeling approach, an interactive model must be used to quantify the overall savings and these savings shall be indicated in the *Savings Summary Worksheet*.

2.2.3 Model Interactive Effect Considerations

It is likely that the algebraic sum of the energy savings of the measures calculated individually will not equal the total energy savings calculated from the interactive model. Since the interactive model incorporates the interactive affects of all the ECMs it is considered the most accurate method for calculating the whole building energy savings.

The *Custom Standard Inputs* tab of the *Savings Summary Worksheet*² will automatically adjust the savings for each measure using a weighed average approach such that the summation of the individual energy savings will not exceed the savings of the interactive model. See Section 5

² The Savings and Incentives Summary Worksheet is a Microsoft Excel spreadsheet that may be downloaded at www.energytrust.org/newbuildings

for more details on the weighted average methodology. Incremental costs for the measures are not modified by the spreadsheet.

The adjusted savings values of the individual measures calculated in the *Custom Standard Inputs* tab automatically populate the *Cost-Effectiveness Calculator* tab. The results of this tab determine if the measure is cost effective.

Below are some interactive model effects that should be considered when analyzing multiple energy conservation measures.

- The baseline system and proposed system shall use the same fuel types. This does not require that they each employ the same system type.
- Measures must be compared against the same fuel (e.g., electric-to-electric, gas-to-gas). However, for hybrid-systems both baseline and proposed models shall be based on that which is specified in Table 4.9 of Appendix L. Please contact the New Buildings program if there are questions regarding modeling a hybrid system baseline.
- Multiple measures may be assessed individually against the baseline, or assessed using a rolling baseline of incremental measures. Measures should be sequenced from the most likely to the least likely to be adopted. The choice of sequence may impact the *Cost-Effectiveness Calculator* test (see Section 5).
- Multiple measures may be combined into one “bundle” of measures when measures are inter-related from a design and cost standpoint (e.g. variable speed pumps and three-way valves). Measures may also be bundled when the interactive energy savings of the bundle exceeds the energy savings of the individual measures when added together. For example if:

Bundled Measure Savings	is	Individual Measure Savings
(A+B)	>	A+B

- For projects that are not a formal SEED project, but are simulating building performance per the SEED Appendix L guidelines, bundling of measures as indicated in Section 3.2 of this manual is not permitted. All measure savings and cost effectiveness shall be assessed per the requirements of Sections 2 and 5.
- The effect of all of the measures to be implemented should be assessed in a total combined interactive case against the baseline.
 - Where separate calculations are used, they should be adjusted to reflect other measures.
 - Likewise, the results of savings calculated outside the model should be reflected in the model whenever possible to ensure interactive effects with other building components
- Responsibility for the accuracy of the analysis resides with the analyst.

2.3 OFTEN OVERLOOKED ITEMS

Frequently items are overlooked and are not included in the energy analysis. Such omissions delay the review process and require the program staff to request additional information.

In an effort to reduce such omissions the following checklist has been created:

- ✓ Identify utility provider and respective rate schedules
- ✓ Identify electric and natural gas incentive amounts (\$/therm, \$/kWh)
- ✓ Confirm that baseline efficiency requirements are based on the Chapter 13 of the Oregon Structural Specialty Code or SEED Appendix L (as applicable)
- ✓ Clearly identify modifications due to code exemptions
- ✓ For each ECM clearly identify the baseline and proposed annual energy and cost savings, and the respective simple payback periods and incentive amounts
- ✓ Clearly identify assumptions, constants, and equations used in spreadsheet calculations
- ✓ Provide electronic versions of all energy models and spreadsheet calculations (unlocked)
- ✓ Confirm that current code revisions and addenda were used in development of the baseline

Submission of **Form 520C: Custom Track Incentive Workbook** requires that the Energy Analysis Report accompany the form. Once received by the program administrator, the report will be reviewed to examine the estimated savings and incentives.

In addition, the program staff will review the calculations to verify that the baseline inputs reflect the baseline parameters described above, and confirm that the results appear accurate and reasonable. If the inputs or resulting estimates do not appear accurate or reasonable then the program requires the project consultant to generate an analysis with accurate and reasonable results. The program's review is for program purposes only, so the program can understand the scope of the project, proposed ECMs, and source of the energy savings. Any questions or comments from the program reviewer are not intended to question the qualifications of the consultant. The program's review is simply intended to confirm whether or not proposed ECMs appear to be eligible to apply for Energy Trust incentive funding. Final determination of whether ECMs are eligible for program incentives rests with the New Buildings program.

3.1 ANALYSIS REPORT AND SUPPORTING DOCUMENTATION

Once the completed Energy Analysis Report is submitted, it will be reviewed by the program to verify the estimated savings and incentives calculated for each ECM. This will require that the supporting calculations and documentation be submitted with the Energy Analysis Report.

Regardless of the calculation method all calculations (i.e. spreadsheets and energy models) shall be submitted in electronic form and “unlocked” so that the calculation equations can be viewed and thus verified (i.e. Microsoft Excel, not .pdf). If proprietary software tools are used to justify energy savings and cannot be unlocked, supporting documentation must be submitted to explain the methodology used to derive the resulting energy savings estimates. The Energy Analysis Report shall be submitted in .pdf format.

The following documentation shall be submitted in order to facilitate the review process:

- Completed Energy Analysis Report (in .pdf format); a template is available at www.energytrust.org/newbuildings.
- All ECM energy savings calculations:
 - Energy simulation models
 - Spreadsheet calculations
 - Manual calculations
- Supporting equipment documentation:
 - Mechanical drawings and equipment schedules (.pdf format)
 - Lighting fixture plans and schedules (.pdf format)
 - Architectural floor plan(s) and elevations as needed (.pdf format)
 - Floor plan(s) identifying the various zones if necessary (.pdf format)

- Equipment product information sheets indicating efficiencies, performance values, and specifications for proposed equipment used in the calculations. It is not required that the product information sheets submitted be “approved” submittal sheets. The purpose of these sheets is to provide manufacturer documentation and substantiation that the proposed, equipment with the performance ratings and specifications used in the calculations, is currently available in the market.
- Schematic diagram showing the mechanical operation and/or layout of the ECM process (e.g. pool heat recovery system with dehumidification). Such diagrams shall be included for ECM systems that are not considered commonly used/installed or may not be easily understood using a written description. Such diagrams shall be provided in the appendix section of the Energy Analysis Report, and not as a separate document.
- Documentation showing the incremental cost basis for the respective ECMs

Please note: the Program reserves the right to ask for additional documentation during the review process.

3.1.1 Spreadsheet and Manual Calculations

The reviewer’s goal is to determine if the calculation approach for each ECM is accurate and acceptable. Manual calculations shall be fully documented.

The following information shall be provided on projects that use spreadsheet and/or manual calculations:

- A list of all assumptions, constants, performance values, and equations
- Documentation to identify and substantiate the assumptions and basis for all usage and weighting factors
- Clear documentation for proprietary, analyst generated, and/or manufacturer licensed spreadsheets/calculation tools. All formulas, assumptions and corresponding cell references shall be clearly identified. Documentation shall provide the reviewer with a clear and logical progression of the results obtained from such calculation tools. User interface input and output data sheets are not acceptable substitutes for calculation documentation in lieu of the above requirements.
- All electronic spreadsheet calculations for each ECM, “unlocked”
- All manual calculations for each ECM

To help expedite the review process, it is recommended that for spreadsheet calculations each ECM be provided on no more than one spreadsheet file (multiple worksheets are permitted). Multiple ECMs may be included in one spreadsheet using multiple worksheets as long as each sheet clearly identifies the corresponding ECM.

3.1.2 Energy Simulation Model

The following information shall be provided on projects that use energy simulation modeling:

- Baseline and proposed building input files (i.e. all .inp, .pd2, .prd files)

3.2 STATE ENERGY EFFICIENCY DESIGN PROGRAM PROJECTS (SEED)

SEED program participants may be eligible for Energy Trust Incentives if the building is served by PGE, Pacific Power, NW Natural or Cascade Natural Gas.

Typically, the New Buildings program requires each individual ECM to be evaluated against the Oregon Structural Specialty Code model baseline in order to evaluate the benefit cost ratio of each ECM. The final Energy Trust incentive for a project is based upon the total interactive or combined measure run of the energy use model.

In an effort to simplify the application process, the Energy Trust New Buildings program will make an exception for projects participating in the SEED program. Baseline ECMs identified and considered cost effective by the SEED program may be combined as a single bundled ECM in the supporting energy analysis and cost-effectiveness calculations for the New Buildings program. The energy savings and incremental cost data for each of the analyzed ECMs shall be used in the New Buildings' cost-effectiveness calculations.

SEED projects seeking incentives through the New Building's program shall identify the estimated annual electrical energy, natural gas energy, and energy cost savings between the code compliant building and the SEED building. Often SEED Energy Analysis Reports tabulate savings results in terms of "mmBtu". As such using the *Savings Summary Incentive Worksheet*³ projects shall clearly identify the electrical, natural gas, and energy cost savings as follows:

For Baseline ECMs:

- Provide the total bundled measure annual electrical (kWh), natural gas (therm), and energy cost savings
- Provide the total interactive bundled measure incremental cost
- The measure life for the bundled baseline ECMs shall be 17.7 years

The Program recognizes that SEED does not require cost effective analysis for the baseline ECMs and that costs for these measures may not be readily available and will require additional efforts by the consultant. However, the Program requires that the bundled package be checked for cost-effectiveness.

For Analyzed ECMs:

- Provide the total annual electrical (kWh), natural gas (therm), and energy cost savings for each ECM
- Provide the incremental cost for each ECM
- The measure lives for each measure shall be those established by Energy Trust of Oregon. SEED measure lives may not be used⁴.

Finally, the Energy Trust incentives will be based upon the total interaction of all of the SEED baseline ECMs and additional individual analyzed ECMs that meet the payback and benefit-cost ratio criteria.

³ The Savings and Incentives Summary Worksheet is a Microsoft Excel spreadsheet that may be downloaded at www.energytrust.org/newbuildings

⁴ See the *Measure Life* tab in the *Savings and Incentives Summary Worksheet*

The Energy Trust New Buildings program awards incentives based on the design and construction of the building. The program does not require monitoring and verification as mandated by SEED.

Results of the energy analysis shall be provided in a comprehensive Energy Analysis Report (EAR). The report should be written such that it can effectively communicate to the building owner:

- Baseline building and system description
- ECM descriptions, how they will operate and yield energy savings over a code equivalent building/system
- The estimated savings, costs and simple payback period of each ECM

Exception: Where a comprehensive energy analysis report has been prepared for a SEED project, the report may be submitted in lieu of the EAR mentioned in this section. However, the program requires that a completed *Savings and Incentives Summary Worksheet* (see Section 3.2) be submitted with the SEED EAR.

A Microsoft Word® document template outlining the various components required in the final Energy Analysis Report is provided, and energy analysts are encouraged to use this template to compile their results, as it will expedite the review process. The report may be found on the program website at: www.energytrust.org/newbuildings.

The report shall contain the following sections and discussion:

- ECM Savings Overview
- Building and System Description
- Summary of Energy Conservation Measures
- Economic Summary
- Summary of ECM Costs
- Appendix

ECM Savings Overview

This section shall provide a brief description of the project and each Energy Conservation Measure (ECM) analyzed. Those ECMs recommended to be incorporated in the design shall be identified.

The level of explanation and detail needed in this section shall be commensurate with that of an executive summary so the reader can identify which ECMs are recommended and understand why.

Building and System Description

This section shall provide an overall description of the project and building as well as any information that is relevant to the energy analysis.

Such items to include in this discussion include, but are not limited to: whether new construction or major renovation, climate zone, building construction type(s), overall square footage, number of stories, occupancy type(s), operating and occupancy schedules, and unique control sequences.

In the case of a major renovation clearly identify those building components and systems that are part of the renovation, and the extent to which they will be renovated and/or replaced.

Summary of Energy Conservation Measures

Provide a summary of each ECM analyzed for the report. Each summary should include a description of the ECM and any details that will help the reader understand how the ECM operates and the source of the energy savings. Address the rationale for any measure 'bundles' in the energy analysis. A comparison of pertinent details between the baseline and the ECM shall be indicated.

Economic Summary

This section shall identify the economics of the potential ECMs and shall include annual energy cost savings (gas and electric), incremental costs, simple payback periods, and the results of the *Cost-Effectiveness Calculator* test.

The dollar value of other non-energy cost savings or value added associated with each measure, if any, should be identified with the respective ECM. Such costs will need to be identified for the purposes of the Cost-Effectiveness-Calculator.

Identify the utility provider's name, corresponding rate schedule and rate amount that the project will be subject to. The energy cost savings shall reflect the appropriate rate schedule amounts.

All the information required for this section of the report can be tabulated using the *Savings and Incentives Summary* worksheet, available at: www.energytrust.org/newbuildings. Once the inputs are performed the worksheet will verify that the ECMs have a simple payback period greater than or equal to one year and whether or not they pass the benefit-cost ratio test of the *Cost-Effectiveness Calculator*.

The tables provided in the *Savings Summary* and *Cost Effectiveness Calculator* tabs of the worksheet shall be provided in this section of the report.

Summary of ECM Costs

For each ECM, the incremental costs (material, equipment and labor) and cost sources (e.g. vendor, RS Means) shall be provided in tabular format. The dollar value of other non-energy cost savings (e.g., reduced operations and maintenance costs) or value added associated with each measure, if any, should be identified with the respective ECM and substantiated.

Incremental labor costs can only be applied to ECMs in which the installation of the proposed ECM requires additional labor above that needed for the installation of the baseline system/component (e.g. labor for installing premium efficiency lighting or motors shall not be included).

Appendix

This section shall include all supporting calculation documentation required for the report, including spreadsheet calculations, energy model report summaries, and an energy model takeoff sheet summarizing the technical inputs to the model that were either obtained from the project drawings or from the design team.

Additionally this section shall contain the equipment manufacturer's specification cut sheets and supporting incremental cost information.

Table 4-1 shall be provided which compares the baseline code requirements to that of the proposed design. For projects that have performed a whole building energy analysis the table shall also indicate the baseline modeling requirements (i.e., SEED Appendix L) used to compare the proposed design.

Table 4-1 – Baseline and Proposed Construction Details

Construction Details	Actual Design	Oregon Energy Code Chapter-13/ SEED Appendix L
Total Conditioned Area (ft ²)		Same
No. of Floors		Same
Building Orientation		
Wall Construction		Used "Assembly Maximum" Value
Wall R-Value		R-13+R-3.8 ci
Roof Construction		Entirely Above Deck-"Assembly Maximum"
Roof R-Value		20 ci
Roof Color Reflectivity		0.30
Floor Construction R-value		Floor R-7.5 for 24 in below (Heated Slab on Grade)
Percent Glazing Area by Façade		Same
Glazing U-value		0.55
Glazing SHGC		0.40
Glazing Transmittance		N/A
Plant Details		
Heating System Type		Natural Draft Boiler
Heating System Efficiency		80%
HW Pump Rated Horsepower (HP)		Used 19 Watts/gpm calc from Appendix G
HW Pumping Controls		Variable Speed Pumping (Primary Only)
HW Supply/Delta T (F)		HWS=180F and HWR=130F
HW Temperature Controls		HW Reset: 180F @ 20F OAT, 150F @ 50F OAT
Cooling System Type		
Packaged Cooling EER - Including Fan Energy		9.0
Packaged Cooling EER - Not Including Fan Energy		10.49
Chilled Water Pumps Size (HP, Head, Flow)		N/A
Chilled Water Pumping Arrangement (CV, VFD)		N/A
Condenser Water Pumps Size (HP, Head, Flow)		N/A
Condenser Water Pumping Arrangement (CV, VFD)		N/A
Cooling Tower Size (Fan HP, airflow, tonnage)		N/A
Cooling Tower Controls (approach, CWST, CV, VFD)		N/A
DHW System		Same
Miscellaneous Loads (not effected by HVAC)		
Parking Lot Lighting (W/ft ²)		0.15
Stadium Lighting		
Mechanical Room (s) Lighting		
Exhaust Fans		
Internal Loads		
Lighting Power Density (W/ft ²)		Courthouse 1.2
Daylighting Controls		None
Lighting Controls		Schedule Control
Equip / Plug Load Density (W/ft ²)		Office 1.34 (ACM Manual N2.2)
Occupancy Density		Office 0.75 (ASHRAE 90.1 User's Manual)
HVAC		
System Type		
Total System Airflow		SAT to Zone 1 20F Difference
Economizer Control		75F Lockout
Design OSA Ratio		Same
Minimum Zone Flow Ratio (CFM/SF)		0.4
Cooling Setpoint- Daytime/Night (F)		
Heating Setpoint- Daytime/Night (F)		
SA Temp Controls		SAT Reset Based on 5F Min.
Operating Schedules/Controls		
Occupancy		Same
Lighting		Same
Office Equipment		Same
Heating Setpoints		Same
Cooling Setpoints		Same
Infiltration		Same
HVAC Fans		Same
DHW		Same
Chiller Schedule		Same
Boiler Schedule		Same

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Individual measures must pass a benefit-cost ratio test using the *Cost-Effectiveness Calculator*. The calculator may be found in the *Savings and Incentives Summary* worksheet available on the Energy Trust website at: www.energytrust.org/newbuildings. Select the *Instructions* tab for instructions on how to use the worksheet.

Using the *Cost-Effectiveness Calculator*, each individual measure, or “bundle” of related measures must have a benefit cost ratio (BCR) of at least 1.0 for both societal and utility cost effectiveness as determined by the program. It is beneficial for the societal test to include other non-energy cost savings or added value resulting from the measure, such as reduced maintenance or inventory, improved market value, improved marketability, etc. An explanation and supporting documentation regarding such non-energy cost savings will need to be included in the appendix of the Energy Analysis Report.

When the values for the individual measures do not sum to the final interactive model, the values are pro-rated using a weighted average on the basis of the interactive value. Adjustment of the individual measure savings values are automatically performed in the *Savings and Incentives Summary* worksheet. The adjusted values are used in the BCR evaluation.

Savings values for projects with multiple measures determined by individual computer runs are adjusted prior to being entered into the Cost-Effectiveness Calculator. This is necessary as the value of an individual measure will be greater in isolation than when combined with other building measures. An approximation of the value of a single measure when acting in concert with all other measures is made by normalizing the individual values such that they sum to the interactive total by:

$$IM_{CEC} = (IM) * (Int) / (\sum IM).$$

Where:

IM_{CEC} = Individual measure value to be used in the CEC

IM = Individual measure value returned from model

Int = Total interactive combined case of all measures

$\sum IM$ = Total of individual measure values returned from model

Table 5-1 lists the measure life for typical systems and equipment used in the Cost-Effectiveness Calculator

Table 5-1 - Systems and Equipment Measure Lives

Architectural Shading	15
Boiler Vent Damper	12
Chillers	23
Clothes Washers	14
Commercial Clothes Washers	9
Commercial Kitchen Steamer	10
Condensing Tank	15
Cooling Tower	20
Demand Control Ventilation	15
Direct Fired Convection Oven	12
Direct-Fired Radiant Heating	18
Domestic Tankless / Instantaneous Water Heater	18
ECM Motor for Refrigeration	12
EMS for Food Prep	15
Freezers	9
Glazing / Windows Custom	15
Heat Exchanger	20
Heat Pumps (Air to Air)	20
Heat Pumps (Ground Source)	20
Heat Pumps (Water Source)	20
Hi Eff Condensing Boiler	35
Hi Eff Condensing Furnace	18
Hi Eff Unit Heater	18
Hot Food Cabinet	15
Ice Machines	12
Infrared Fryer	8
Infrared Griddle	8
Kitchen Vent Hood	15
Light Fixtures	10
Lighting Controls	15
Low Emissivity Coating	25
Motors	15
Occupancy / Daylight Controls	10
PT Heat Pump	12
Refrigerators	9
Roof Insulation	45
Screw-in CFL	2
Showerheads	15
Single Tank Conveyor Dishwasher	20
Single Tank Door/Upright Dishwasher	15
Single Unit Clothes Washer (multi-family)	14
Undercounter Hi Temp Dishwasher	10
Unit Heaters	18
VSD	15
Wall Insulation	45

For SEED projects each analyzed ECM shall use the New Buildings' measure life rather than the SEED measure life when performing the ETO cost-effectiveness calculation for this measure.

For SEED projects the bundle of baseline ECMs shall use a measure life of 17.7 years when performing the ETO cost-effectiveness calculation for the bundled measure.