



USE ENERGY MODELING Step 2

Energy modeling helps determine which energy saving features are most cost effective. Energy modeling software is an important design tool that helps builders identify the least expensive measures required to create a zero energy home. Modeling should be conducted in multiple iterations of the design, analyzing the energy impact of different design choices, such as a ground source heat pump versus an air source heat pump, or comparing the impact of R-30 wall insulation with that of R-60 wall insulation.

Energy modeling can be done as soon as the designer creates preliminary plans with dimensions, elevations, basic floor plan, and windows and doors. The plans can then be adjusted based on the modeling results so that the project will reach the net zero energy goal at the lowest cost possible. Decisions made during energy modeling will be reflected in the final plan and construction documents. [The payback on the costs of energy modeling itself](#) – a matter of a couple of months – is surprisingly short.

Any energy-saving upgrade that costs less per kWh saved than the cost per kWh of installed PV would be considered cost effective and should be integrated into the plan. By using energy modeling to help ensure the cost effectiveness of energy saving measures, the [added costs](#) of constructing a zero energy home can be as little as 5% of the sales price, after rebates and tax incentives, depending on the state.



Energy Savings Comparison Chart

The secret to affordable zero energy homes is making small improvements to many specific building elements, such as air sealing, insulation, heating and cooling systems, and solar. Skillful use of modeling tool allows you to [optimize the package](#) of elements that makes sense for your budget.

Bruce Sullivan of [BaseZero, LLC](#) created the following chart based on a house in Bend, Oregon. It provides a rough sample of the relative energy savings from boosting the efficiency of specific components. Because results will vary depending on building details, climate and other factors, it is recommended that designers and builders conduct a similar exercise for each net zero energy project.

Improvement	Energy Savings in BTUs
Wall from R30 to R40	200,000
Floor from R38 to R44	500,000
Windows from U-0.28 to U-0.22	700,000
Heat Pump HSPF from 9.5 to 10.5	300,000
ACH from 2.5 to 1.5	700,000
Adding 1 kWh of PV panels	4,800,00
Adding one 180 Watt PV panel	796,000
Ceilings from R50 – R60	300,000

It is important to factor in the cost of each improvement when comparing their relative energy savings. Further upgrades will give smaller returns, so that upgrading an energy saving feature beyond a certain point may not be cost-effective any longer. Similarly, upgrading one component will affect the impact of upgrading other components. Energy modeling will help determine the point at which returns in efficiency are no longer cost effective as well as what combination of energy saving measures amounts to the highest savings.

It's nearly impossible to pinpoint the exact net cost of different energy measures because they vary over time and across home building markets. But while energy modeling only provides an estimate, it gives useful guidance as to the relative cost/benefit of each energy-saving measure considered.

Energy Modeling Software Directory

The following links provide information about some of the different energy modeling software that is available:

[Energy Gauge](#), Florida Solar Energy Center

[Energy 10](#), Sustainable Buildings Industry Council (SBIC)

[REM Design](#) While not the most accurate or comprehensive energy modeling program available, it is relatively easy to use and quickly provides some of the most helpful energy modeling comparisons. A functionally identical program called REM/Rate is used by certified home energy raters.

[EnergyPlus](#) Published by the U.S. Department of Energy, this is a highly sophisticated modeling engine.

[BeOpt](#), National Renewable Energy Laboratory. BeOpt is unique because it allows many options to be compared directly. By entering the cost of each option, the program suggests an optimum package for cost-effectively designing a zero energy home. This provides a graphical user interface for EnergyPlus. [Learn more about BeOpt from the Green Building Advisor.](#)

[HEED](#) shows how much energy and money and carbon you can save by making various design or remodeling changes to a home with this free new easy-to-use program. You can draw in the floor plan of a house, then click and drag windows to their correct location.

[Passive House Planning \(Design\) Package](#), (PHPP), Passive House Institute. PHPP may well be the ultimate in energy modeling, however it requires very detailed information and can be time-consuming and expensive. To use this program effectively, you must attend Passive House Consultant training.

[Building Energy Software Tools Directory](#), U.S. Department of Energy. This is a comprehensive and alphabetical directory of energy modeling programs, gathered by the U.S. Department of Energy.

Carbon Foot Printing and Life Cycle Assessment Software

[One Click LCA](#) allows designers to import building data from X-cel, Revit, and BIM packages to run standards-based life cycle assessments, carbon footprinting, and job costing.

[BuildingScope](#) is a web-based tool used to model and analyze environmental life cycle impact, greenhouse gas emissions and energy use.

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Zero Energy Home Care
Positive Energy Homes
Appraisal and Mortgage Strategies for Zero Homes
Case Studies

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Zero Homes are Comparable in Cost to Standard Homes
Net Zero Home Sales and Appraiser Courses Online
Appraisal and Mortgage Strategies for Zero Homes
Sales Kit
Glossary of Zero Energy Terms

RENOVATOR

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