



Instructions for Using ENERGY STAR® Builder Option Packages CT Light And Power Co. & United Illuminating Co. Connecticut-Specific BOPs



Builder Option Packages (BOPs) are a prescriptive method for labeling new homes ENERGY STAR. BOPs specify levels and limitations for the thermal envelope (insulation and windows), HVAC and water heating equipment efficiencies for a specific climate zone. BOPs require a third-party verification, including testing the leakage of the envelope and duct system, to ensure the requirements have been met. Follow these steps to build an ENERGY STAR labeled home using a BOP:

1. To find the BOP, visit the ENERGY STAR Web site at www.energystar.gov/homes. Click on "Builder Option Packages" under the "Quick Links" section.
2. Choose the state and county where the home will be built, and open the file. Opening the BOP files requires Adobe Acrobat Reader; a free version of Adobe Acrobat Reader can be downloaded from www.adobe.com.
3. Identify the package (i.e., BOP Number) that you are interested in building. There may be more than one page of BOPs to choose from, depending on your location. Make sure that the house you are building meets the limitations of the package. For example, if the prospective home has 16% window area, the BOP selected must meet or exceed the corresponding limitation - i.e., choose a BOP that allows \leq 18% or 21% window area.
4. Build the home, following all the BOP specifications. For clarification on certain items please read the attached "Footnotes" section.
5. Contact a BOP Provider to get your home inspected and labeled ENERGY STAR. BOP Providers can be located on the Partner Locator of the ENERGY STAR Web site at www.energystar.gov/homes.
6. The BOP Provider will send a BOP Inspector to verify the home meets or exceeds all requirements listed in the BOP. Verification of the home typically includes testing the air leakage of the envelope and duct system. If the home complies with the BOP, the Inspector will sign and date the BOP sheet. This sheet is then filed with the BOP Providers for their records.
7. For home buyers interested in an energy efficient mortgage or ENERGY STAR mortgage, Fannie Mae requires estimated monthly energy cost savings. For BOPs, these estimates are determined using the monthly cost savings table below. To use this table:
 - Choose the number of stories and home size that most closely fits the home being built and locate the estimated monthly savings, based on the appropriate heating fuel type.
 - Insert the estimated monthly cost savings in the appropriate line at the bottom of the BOP sheet. Note that these estimated savings should NOT be used as basis for guaranteeing utility bills. This should only be done on a case by case basis with a qualified energy modeling tool.
 - Submit a copy of the signed BOP, which includes the estimated monthly cost savings, with your loan request forms.

Estimated Monthly Cost Savings Table for CT Light And Power Co. & United Illuminating Co. Connecticut-Specific BOPs:						
Foundation Type: Number of Stories Above Grade: Home Size (SF Per Floor):	Basement					
	Single Story			Double Story		
	1,000	2,000	2,500	1,000	2,000	2,500
Estimated Monthly Savings - Gas Heating Packages:	\$30	\$45	\$55	\$50	\$70	\$85
Estimated Monthly Savings - Oil Heating Packages:	\$45	\$65	\$80	\$70	\$100	\$120



Builder Option Packages for ENERGY STAR® Labeled Homes



Builder Name: _____

House Address: _____ State: _____

CT Light And Power Co. & United Illuminating Co. Connecticut-Specific BOPs¹

Only homes in the following counties can use the Northeast Utility Connecticut Specific BOPs designed for CZ 12 – Fairfield, Middlesex, New Haven, & New London.

BOP Selected	BOP Number	Applicable Climate Zone ²	Window Req's.			Minimum Insulation Requirements ³						Minimum Equipment Requirements ⁴													
			Max Window Area ⁵	Window U-value	Window SHGC ⁶	Max %		Exterior Wall Framing Type	Exterior Wall ⁷	Floor Over Bsmnt	Floor Over Garage	Gas Furnace Htg / Elec Clg			Oil Furnace Htg / Elec Clg			Gas Hydronic Htg / Elec Clg			Oil Hydronic Htg / Elec Clg			Duct Leakage ¹⁰ (CFM / [CFM to unconditioned spaces] at 25 Pascals;	
						Attic	Ceiling					Cathedral Ceiling	Attic	Cool	DHW ⁹	Heat (AFUE)	Cool (SEER)	DHW ⁹ (E/O EF)	Heat (AFUE)	Cool (SEER)	DHW ⁹ (E/G EF)	Heat (AFUE)	Cool (SEER)		DHW ⁹ (Oil EF)
1	12	12	20%	<= 0.35	>= 0.35	R- 30	20%	R- 30	2x4	R- 15	R- 11	R- 30	90%	13	0.86 / 0.56	82%	13	0.86 / 0.60	85%	13	0.86 / 0.56	85%	13	(ind.)	10%
2	12	12	20%	<= 0.35	>= 0.35	R- 30	20%	R- 30	2x6	R- 19	R- 19	R- 30	90%	13	0.86 / 0.56	80%	13	0.86 / 0.60	85%	13	0.86 / 0.56	85%	13	(ind.)	10%

BOP Provider Company's Name:	_____	BOP Provider's Address:	_____
BOP Provider Phone number:	_____		_____
BOP Inspector's Name:	_____	BOP Inspection Company's Name:	_____
Inspection Date:	_____	Estimated Monthly Cost Savings:	_____

Additional Requirements for CT Light And Power Co. & United Illuminating Co. Connecticut-Specific BOPs

Envelope		Equipment			Design Limitations	
Infiltration ⁸	Door	Thermostat	Duct Insulation ¹¹	Ventilation	Above Grade Area per Floor	Window Orientation
<= 0.35 ac/h; blower door tested	>= R-5	Programmable	Insulate ducts in unconditioned spaces to R-8	Active ventilation recommended	<= 2500 S.F.	<= 62.5% of allowable Maximum Window Area (see pg.2) can be located on the North and East

Footnotes:

- 1) Meeting all the requirements in a Builder Option Package (BOP) qualifies an individual home as ENERGY STAR compliant. ENERGY STAR labeled homes are designed to use at least 30% less energy than the Home Energy Rating System (HERS) Reference Home and at least 15% less energy than local code in heating, cooling, and domestic water heating. Homes that do not meet the requirements in the BOPs should be certified by a local HERS rater. Homes built to BOP specifications must be verified by a RESNET-approved BOP Provider, in accordance with the EPA/RESNET Agreement on BOPs (see www.natresnet.org/bop/agreement.htm). Additional efficiency and savings can be achieved by selecting other ENERGY STAR labeled products throughout the house (e.g., lighting, appliances). For more information, visit www.energystar.gov. Regardless of these specifications, all local codes must be followed.
- 2) Only homes in the following counties can use the Northeast Utility Connecticut Specific BOPs designed for CZ 12 – Fairfield, Middlesex, New Haven, & New London. Only homes in the following counties can use the Northeast Utility Connecticut Specific BOPs designed for CZ 13 & 14 – Hartford, Litchfield, Tolland, & Windham. Homes built in counties other than those listed should be certified by a local HERS rater.
- 3) Thermal requirements vary with local building codes. Ensure that insulation levels meet all relevant codes. The BOPs were developed for homes using wood framing. If metal framing is used, consult a local HERS rater to determine additional upgrades necessary to achieve similar thermal performance, such as additional insulated sheathing. The insulation R-Value of each component (i.e., attic, exterior wall, etc.) must meet or exceed the required level designated in the BOP. The overall R-Value for components with multiple insulating levels can be determined by calculating a weighted average of the R-Values (based on the percentage of the total area each constituent covers).
- 4) Install properly sized HVAC equipment. Recommended sizing methods: size heating & cooling equipment to Air Conditioning Contractors of America (ACCA) Manual S specifications; size ducts to Manual D specifications, both based on Manual J load calculations.
- 5) Maximum window area is a ratio of total window unit area to total above-grade conditioned floor area (WFA). For example, a house with total above-grade conditioned floor area of 2,000 square feet and total window area of 400 square feet has a WFA of $400/2,000 = 20\%$. Regardless of the maximum window area, up to 0.5% WFA may be used for windows with decorative glass (e.g., doesn't meet U-value or SHGC requirements). Likewise, a maximum of 1.0% WFA may be used for skylights. For example, a house with total above-grade conditioned floor area of 2,000 square feet may have only 10 square feet (0.5% of 2,000) of decorative glass and 20 square feet (1% of 2,000) of skylight area. All decorative glass and skylight window area counts towards the maximum window area designated in the BOPs.
- 6) Window solar screens may be used to meet SHGC requirements. The overall SHGC for a window unit with solar screen is determined by the following equation: $[(\text{window SHGC}) \times (\text{solar screen SHGC}) \times (\text{percent of area covered})] + [\text{window SHGC} \times (\text{percent of area not covered})]$. For example, a window with a SHGC of 0.5, using a solar screen that provides 70% shading (the equivalent of 0.3 solar heat gain coefficient) and covers 60% of the window has an overall solar heat gain coefficient of $[0.5 \times 0.3 \times 0.6] + [0.5 \times 0.4] = 0.09 + 0.20 = 0.29$.
- 7) Insulated Concrete Form (ICF) walls must include a minimum 4" concrete thickness with minimum total form insulation of R-12. An ICF wall can be substituted for all BOPs with wall insulation levels <= R-17. A 4.5" Structural Insulated Panel (SIP) must have an overall insulation level >= R-15.5. A 4.5" SIP wall can be substituted for all BOPs with wall insulation levels <= R-17.
- 8) The required infiltration rate of 0.35 ac/h is equivalent to 0.93 CFM50/sf of conditioned space. To ensure acceptable indoor air quality, it is recommended that homes are built in compliance with ASHRAE Standard 62.2-2003. This Standard requires that a mechanical exhaust system, supply system, or combination thereof be installed for each dwelling unit to provide whole-building ventilation with outdoor air at a minimum specified rate. For a typical home (1500-3000 ft² of conditioned space and 2-3 bedrooms), this required level is 45-60 cfm (approximately 0.15-0.30 nach). To maximize energy savings it is recommended that a heat recovery ventilation system be used in cold and moderate climates and an energy recovery ventilation system be used in hot climates.
- 9) Efficiency requirements of domestic water heaters are listed as minimum energy factors (EF) by fuel type (i.e., E for electric, G for gas, O for Oil). A required EF of 2.0 represents the performance of a typical electric heat pump water heater. "Ind." represents the requirement of an indirect storage water heater (e.g., a separate zone off of the boiler).
- 10) The required duct leakage rate of 6% is equivalent to 1.0 CFM25 / 29.0 square feet of conditioned floor area. The required duct leakage rate of 10% is equivalent to 1.0 CFM25 / 17.5 square feet of conditioned floor area. Duct leakage tests such as the blower door subtraction method or simultaneous duct blaster and blower door testing can be used to measure duct leakage to unconditioned space.
- 11) A minimum of R-4 duct insulation is recommended for ducts in conditioned space to prevent condensation.