

APPENDIX I

Homebuyer's Checklist

Below is a more detailed list of building features for those who really want to investigate their house. To really see how some of these measures are installed, visit houses that are under construction.

MEASURE	Building America	Builder #1	Builder #2	Builder #3
HEATING AND COOLING EQUIPMENT				
ENERGY STAR qualified air conditioning of SEER 13 or greater	Yes			
ENERGY STAR qualified heat pump	Yes			
ENERGY STAR qualified boiler	Yes			
ENERGY STAR qualified furnace of AFUE 90	Yes			
ENERGY STAR qualified programmable thermostat	Yes			
Ductwork sealed with mastic (no duct tape)	Yes			
5% or less duct leakage found with pressure test.	Yes			
Duct Insulation: R-4 in conditioned space, R-8 in attic, R-6 in crawlspace	Yes			
House plans show duct layouts	Yes			
Ducts located in conditioned space as much as possible	Yes			
Ducts sized according to industry standards in Manual D	Yes			
Heating and cooling equipment sized according to industry standards in Manual J	Yes			
House pressure balanced with jump ducts	Yes			
HVAC* equipment and duct work was inspected and tested after installation	Yes			
INSULATION <i>(take a look at a house under construction before sheetrock is installed)</i>				
Insulation installed behind tubs, landings, and other hard to reach places.	Yes			
Insulation fills entire cavities – no voids or compressed batts – Attic insulation level without gaps and covers entire attic floor	Yes			
High density batt insulation	Yes			
Rim joists are insulated	Yes			
WINDOWS <i>(take a look at a house under construction before exterior siding is installed)</i>				
ENERGY STAR qualified windows, doors, and skylights	Yes			
Windows flashed to help repel water	Yes			
Windows rated to .35 U-factor and SHGC	Yes			

Energy & Housing Glossary

Accreditation

The process of certifying a Home Energy Rating System (HERS) as being compliant with the national industry standard operating procedures for Home Energy Rating System.

AFUE Annual Fuel Utilization Efficiency (AFUE)

Measures the amount of fuel converted to space heat in proportion to the amount of fuel entering the furnace. This is commonly expressed as a percentage. A furnace with an AFUE of 90 could be said to be 90% efficient. AFUE includes any input energy required by the pilot light but does not include any electrical energy for fans or pumps.

Air Flow Retarder

Sealants used to keep outside air and inside air out of the building envelope. Four common approaches to retarding air flow include careful sealing using the following building components: drywall and framing, plastic sheets (should not to be used in hot and humid climates) between drywall and framing, exterior sheathing, and building paper. Air flow retarders define the pressure boundary in a house that separates indoor and outdoor air.

Building Envelope

The outer shell, or the elements of a building, such as walls, floors, and ceilings, that enclose conditioned space. See also *Pressure Boundary* and *Thermal Boundary*.

Btu (British Thermal Unit)

A standard unit for measuring energy. One Btu is the amount of energy required to raise the temperature of one pound of water by one degree Fahrenheit from 59 to 60. An Inches-Pounds unit.

CABO (Council of American Building Officials)

A national organization of building code officials and interested parties, which, through a national consensus process, developed, adopted and promulgated the national Model Energy Code (MEC). CABO has recently become CABO International and has taken on the administrative responsibility for the development of a uniform international building code through an International Code Council (ICC).

Capacity

The rate at which a piece of equipment works. Cooling capacity is the amount of heat a cooling system can remove from the air. For air conditioners total capacity is the sum of latent capacity, the ability to remove moisture from the air, and the sensible capacity, the ability to reduce dry-bulb temperature. Heating system capacity indicates how much heat a system can provide. Heating and cooling capacities are rated in Btu per hour.

Chase

A furred out enclosure designed to hold ducts, plumbing, electric, telephone, cable, or other linear components. A chase designed for ducts should be in conditioned space and include air flow retarders and thermal barriers between it and unconditioned spaces such as attics.

Construction Documents

The drawings (plans) and written specifications that describe construction requirements for a building.

COP (Coefficient of Performance)

A measure of efficiency typically applied to heat pumps. The COP for heat pumps is the ratio, at a given point in time, of net heat output to total energy input expressed in consistent units and under designated conditions. Heat pumps result in a COP greater than 1 because the system delivers or removes more heat energy than it consumes. Other specific definitions of COP exist for refrigeration equipment. See HSPF for a description of a unit for seasonal efficiency.

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Debt-to-Income Ratio

The ratio, expressed as a percentage, which results when a borrower's total monthly payment obligations on long-term debt are divided by their gross monthly income. This is one of two ratios (housing expense-to-income ratio being the other) used by the mortgage industry to determine if a prospective borrower qualifies (meets the underwriting guidelines) for a specific home mortgage. Fannie Mae, Freddie Mac and FHA underwriting guidelines set an upper limit of 36% on this value for conventional loans but increase ("stretch") the ratio by 2% for qualifying energy efficient houses.

Dry-Bulb Temperature

The temperature of air indicated on an ordinary thermometer, it does not account for the affects of humidity.

ECM (Energy Conservation Measure)

An individual building component or product that directly impacts energy use in a building and has a set of differentiable energy performance factors that can be arranged into a table or list. For example, wall insulation is a measure that will impact heat transfer to and from a building, and there is some list of wall measures that are differentiated by insulation R-value that define the possible walls that can be incorporated into a building.

EEM (Energy Efficient Mortgage)

Specifically, a home mortgage for which the borrower's qualifying debt-to-income and housing expense-to-income ratios have been increased ("stretched") by 2% because the home meets or exceeds CABO's 1992 version of the Model Energy Code (MEC). This so-called "stretch" mortgage is nationally underwritten by Fannie Mae, Freddie Mac and the Federal Housing Administration (FHA). This term is often used generically to refer to any home mortgage for which the underwriting guidelines have been relaxed specifically for energy efficiency features, or for which any form of financing incentive is given for energy efficiency.

EER (Energy Efficiency Ratio)

A measurement of the instantaneous energy efficiency of cooling equipment, normally used only for electric air conditioning. EER is the ratio of net cooling capacity in Btu per hour to the total rate of electric input in watts, under designated conditions. The resulting EER value has units of Btu per Watt-hour.

EF (Energy Factor)

A standardized measurement of the annual energy efficiency of water heating systems. It is the annual hot water energy delivered to a standard hot water load divided by the total annual purchased hot water energy input in consistent units. The resultant EF value is a percentage. EF is determined by a standardized US Department of Energy procedure.

Energy (use)

The quantity of electricity, gas or other fuel required by the building equipment to satisfy the building heating, cooling, hot water, or other loads or any other service requirements (lighting, refrigeration, cooking, etc.).

Energy Audit

A site inventory and descriptive record of features impacting the energy use in a building. This includes, but is not limited to: all building component descriptions (locations, areas, orientations, construction attributes and energy transfer characteristics); all energy using equipment and appliance descriptions (use, make, model, capacity, efficiency and fuel type) and all energy features.

ENERGY STAR® Home

A home, certified by the US Environmental Protection Agency (EPA), that is at least 30% more energy efficient than the minimum national standard for home energy efficiency as specified by the 1992 MEC, or as defined for specific states or regions. ENERGY STAR is a registered trademark of the U.S. EPA.

Envelope

See Building Envelope

Fannie Mae

(FNMA - Federal National Mortgage Association)

A private, tax-paying corporation chartered by the U.S. Congress to provide financial products and services that increase the availability of housing for low-, moderate-, and middle-income Americans.

FHA (Federal Housing Administration)

A division of the Department of Housing and Urban Development (HUD). FHA's main activity is the insurance of residential mortgage loans made by private lenders.

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Freddie Mac

(FHLMC - Federal Home Loan Mortgage Corporation)

A stockholder-owned organization, chartered by the U.S. Congress to increase the supply of mortgage funds. Freddie Mac purchases conventional mortgages from insured depository institutions and HUD-approved mortgage bankers.

Grade Beam

A foundation wall that is poured at or just below the grade of the earth, most often associated with the deepened perimeter concrete section in slab-on-grade foundations.

HERS (Home Energy Rating System)

A standardized system for rating the energy-efficiency of residential buildings.

HERS Energy-Efficient Reference Home (EERH)

The EERH is a geometric “twin” to a home being evaluated for a HERS rating and is configured to be minimally compliant with the 1992 MEC.

HERS Provider

An individual or organization responsible for the operation and management of a Home Energy Rating System.

HERS Rater

An individual certified to perform residential Building Energy Efficiency Ratings in the Class for which the Rater is certified. There are three classes of residential Rater certification: Class 3 - requiring the certified capability to complete Ratings based on construction documents; Class 2 - requiring the certified capability to complete Ratings based on site energy audits; and Class 1 - requiring the certified capability to complete Ratings based on site energy audits and performance tests.

HERS Score

A value between 0 and 100 indicating the relative energy efficiency of a given home as compared with the HERS Energy-Efficient Reference Home as specified by the HERS Council Guidelines. The greater the score, the more efficient the home. A home with zero energy use for the rated energy uses (heating, cooling and hot water only) scores 100 and the HERS Reference Home scores 80. Every 1-point increase in the HERS score amounts to a 5% increase in energy efficiency.

Housing Expense-to-Income Ratio

The ratio, expressed as a percentage, which results when a borrower’s total monthly housing expenses (P.I.T.I.) are divided by their gross monthly income. This is one of two ratios (debt-to-income ratio being the other) used by the mortgage industry to determine if a prospective borrower qualifies (meets the underwriting guidelines) for a specific home mortgage. Fannie Mae, Freddie Mac and FHA underwriting guidelines set an upper limit of 28% on this value for conventional loans but increase (“stretch”) the ratio by 2% for qualifying Energy Efficient Mortgages.

Housewrap

Any of several spun-fiber polyolefin rolled sheet goods for wrapping the exterior of the building envelope.

HSPF (Heating Season Performance Factor)

A measurement of the seasonal efficiency of an electric heat pump using a standard heating load and outdoor climate profile over a standard heating season. It represents the total seasonal heating output in Btu divided by the total seasonal electric power input in watt-hours (Wh). Thus, the resultant value for HSPF has units of Btu/Wh.

Jump Duct

A flexible, short, U-shaped duct (typically 10-inch diameter) that connects a room to a common space as a pressure balancing mechanism. Jump ducts serve the same function as transfer grilles.

Load

The quantity of heat that must be added to or removed from the building (or the hot water tank) to satisfy specific levels of service, such as maintaining space temperature or hot water temperature at a specified thermostat setting (see also the definitions of energy and thermostat).

Low-E

Refers to a coating for high-performance windows, the “e” stands for emissivity or re-radiated heat flow. The thin metallic oxide coating increases the U-value of the window by reducing heat flow from a warm(er) air space to a cold(er) glazing surface. Low-e coatings allow short-wavelength solar radiation through windows, but reflect back longer wavelengths of heat.

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MEC (Model Energy Code)

A “model” national standard for residential energy efficiency. The MEC was developed through a national consensus process by the Council of American Building Officials (CABO) and is the accepted national minimum efficiency standard for residential construction. Since MEC is a model code, it does not have the “force of law” until it is adopted by a local code authority. The MEC is used as the national standard for determining Energy Efficient Mortgage (EEM) qualification, and it serves as the national “reference point” used by Home Energy Rating Systems (HERS) in the determination of energy ratings for homes.

Mechanical Ventilation

The active process of supplying or removing air to or from an indoor space by powered equipment such as motor-driven fans and blowers, but not by devices such as wind-driven turbine ventilators and mechanically operated windows.

Performance Test

An on-site measurement of the energy performance of a building energy feature or an energy using device conducted in accordance with pre-defined testing and measurement protocols and analysis and computation methods. Such protocols and methods may be defined by national consensus standards like those of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) and the American Society for Test and Measurement (ASTM).

P.I.T.I.

An abbreviation which stands for principal, interest, taxes, and insurance. These generally represent a borrower’s total monthly payment obligations on a home loan. The taxes and insurance portion are often paid monthly to an impound or escrow account and may be adjusted annually to reflect changes in the cost of each.

Pressure Boundary

The point in a building at which inside air and outside air are separated. If a building were a balloon, the rubber skin would form the pressure boundary. Where inside and outside air freely mingle there is no pressure boundary.

Pressurization Test

A procedure in which a fan is used to place a house, duct system, or other container, under positive or negative air pressure in order to calculate air leakage.

RESNET (Residential Energy Services Network)

The national association of energy rating providers.

Rated Home

A specific residence that is evaluated by an energy rating.

R-Value

Measures a material’s ability to slow down or resist the transfer of heat energy, also called thermal resistance. The greater the R-value, the better the resistance, the better the insulation. R-values are the reciprocal of U-values. See U-values for more information.

Sealed Combustion

Sealed combustion means that a combustion appliance, such as a furnace, water heater, or fireplace, acquires all air for combustion through a dedicated sealed passage from the outside; combustion occurs in a sealed combustion chamber, and all combustion products are vented to the outside through a separate dedicated sealed vent.

SEER (Seasonal Energy Efficiency Ratio)

A measurement similar to HSPF except that it measures the seasonal cooling efficiency of an electric air conditioner or heat pump using a standard cooling load and outdoor climate profile over a standard cooling season. It represents the total seasonal cooling output in Btu divided by the total seasonal electric input in watt-hours (Wh). The SEER value are units of Btu/Wh.

Semi-Permeable

The term vapor semi-permeable describes a material with a water vapor permeance between 1 and 10 perms. Water vapor can pass through a semi-permeable material but at a slow rate.

Shading Coefficient (SC)

The ratio of the total solar heat admittance through a given glazing product relative to the solar heat admittance of “double-strength, clear glass at normal solar incidence (i.e. perpendicular to the glazing surface).

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Solar Heat Gain Coefficient (SHGC)

SHGC measures how well a window blocks heat caused by sunlight. The lower the SHGC rating the less solar heat the window transmits. This rating is expressed as a fraction between 0 and 1. The number is the ratio of a window's solar heat admittance compared to the total solar heat available on the exterior window surface at normal solar incidence (i.e. perpendicular to the glazing surface).

Sone

A sound rating. Fans rated 1.5 sones and below are considered very quiet.

Supply ducts

The ducts in a forced air heating or cooling system that supply heated or cooled air from the or air conditioner to conditioned spaces.

Thermal Boundary

The border between conditioned and unconditioned space where insulation should be placed.

Thermostat

A control device that measures the temperature of the air in a home or the water in a hot water tank and activates heating or cooling equipment to cause the air or water temperature to remain at a pre-specified value, normally called the set point temperature.

Ton(s) of Refrigeration

Units used to characterize the cooling capacity of air conditioning equipment. One ton equals 12,000 Btu/h.

U-Value

Measures the speed at which heat flows or conducts through a building assembly (wall, floor, ceiling, etc.). The smaller the u-value the more energy efficient an assembly and the slower the heat transfer. Window performance labels include U-values (calling them U-factors) to help in comparing across window products.

Ventilation

The controlled movement of air into and out of a house.

W (watt)

One of two (Btu/h is the other) standard units of measure (SI –or metric- System) for the rate at which energy is consumed by equipment or the rate at which energy moves from one location to another. It is also the standard unit of measure for electrical power.

Wet-Bulb Temperature

A measure of combined heat and humidity. At the same temperature, air with less relative humidity has a lower wet bulb temperature. See *Dry-Bulb Temperature*.

Wind-Washing

Air movement due to increased pressure differences that occur at the outside corners and roof eaves of buildings. Wind-washing can have significant impact on thermal and moisture movement and hence thermal and moisture performance of exterior wall assemblies.

Xeriscaping

Landscaping that minimizes outdoor water use while maintaining soil integrity and building aesthetics. Typically includes emphasis on native plantings, mulching, and no or limited drip/subsurface irrigation.

Zero Energy House

Any house that over time, averages out to net zero energy consumption. A zero energy home may supply more energy than it needs during peak demand, typically using one or more solar energy strategies, energy storage and/or net metering.

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Sources & Additional Information

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- Home Energy Magazine. 1997. "No-Regrets Remodeling: Creating a Comfortable, Healthy Home That Saves Energy." Energy Auditor & Retrofitter, Inc. Berkeley, CA.

APPENDIX I: HOMEBUYER'S CHECKLIST

MOISTURE MANAGEMENT <i>(take a look at a house under construction before exterior siding is installed)</i>				
Ground slopes away from house	Yes			
Housewrap or building paper covers exterior sheathing in wood framed houses	Yes			
Roof flashing in valleys, where walls and roofs intersect, and at other places where water may enter the house – the more complex the roof, the more flashing you should see.	Yes			
Overhangs for shade and to direct water away from walls	Yes			
AIR RETARDERS				
All penetrations through exterior walls sealed	Yes			
Careful sealing of sheetrock or exterior sheathing	Yes			
Canned lights rated as airtight and for insulated ceiling (ICAT)	Yes			
Electrical boxes on exterior walls caulked or gasketed	Yes			
Holes into attic sealed	Yes			
Air leakage determined with house depressurization test	Yes			
SLAB FOUNDATION MEASURES				
Radon vent pipe installed	Yes			
4 to 6 inch gravel base	Yes			
Polyethylene (plastic) vapor barrier below gravel	Yes			
PLUMBING				
No pipes in exterior walls	Yes			
YOUR FEATURES FOR COMPARISON				

**HVAC = heating, ventilation, and air conditioning*

If you want to know more about any of these or other house features review the other chapters of the *Best Practices* guide. Other chapters are designed to help site planners, designers, site supervisors, and crafts people design and build efficient, comfortable, and durable homes.