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Energy Efficient Homes: Comparing Homes for Energy Efficiency[1]

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When buying a home in Florida, you have to consider a whole range of factors: location, price, room layout, yard size, and so on. But people are becoming more aware of yet another factor, one that can make a difference in terms of daily comfort *and* economic comfort: energy efficiency. In this respect, location is probably the most significant of all—the closer the home is to your place of work, school, shopping, or other frequently-visited places, the less energy you'll use for transportation. Over the home's lifetime, this can add up enormously.

Savings accumulated by living in an energy efficient home are not insignificant—they can exceed $1000 annually compared to similar, less efficient homes in the same area. So it makes sense to consider a home's water heating and air-conditioning systems, its insulation, as well as the home's neighborhood or proximity to schools and shopping.

Once you've narrowed down the list of potential homes you're considering to two or three, then you can start evaluating each home's energy efficiency. This fact sheet includes a checklist to help you do this. Duplicate the list and carry one on a clipboard as you evaluate each home; there is a place to record brief notes to yourself beside each item. Note that some items on the checklist are not mentioned in this overview; look for more information in the UF/IFAS online publication database, EDIS (Electronic Data Information Source), at http://edis.ifas.ufl.edu/TOPIC_SERIES_Energy_Efficient_Homes.

Keep in mind that a house is not just a shell—it's an energy *system*. It's not only a shelter, but also a controlled environment, the design of which is intended to help you manage (among other things) the movement and amount of heat, air, and moisture. Every part has an impact on the system, so it's a big mistake to look at any single element separately from all others. For instance, having an energy efficient air conditioner won't lower the monthly utility bill much if the duct system has leaks, the attic is uninsulated, and humid summer breezes are drifting in under the door. All components of the home energy system need to be considered.

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Quick Facts

In choosing an energy efficient Florida home, you need to know its energy "budget". In other words, where does the energy go?

- 40% or more of a typical Florida home's energy use is used for heating, ventilation, and air-conditioning (HVAC), the largest portion of which is devoted to cooling.
- 13 – 17% of a home's energy use is used for heating water, while
- 22% is attributed to lighting and refrigeration needs.
- The remainder of a typical Florida home's energy use, 21 – 25% of the power consumption, is used for home appliances, electronics, and other "plug loads."

The local utility company may show you a home's utility bills for the previous year (or the home's current owner can request them). This can be a help in deciding which home to buy or learning more about the property you are most interested in—but bear in mind that the rhythms and habits of the residents can make a big difference in the size of the utility bill. For example, a family with three teenagers will use far more water for laundry and bathing than a retired couple. Occupants who leave the patio doors wide open in summer will demand far more of their air conditioner than those who don't.

Terms to Help You Get Started

- **Building Envelope**: The building's exterior shell—walls, foundation, floors, ceiling, windows, doors, and roof; generally considered the boundary between the indoor cooled or heated area and the outdoors; sometimes referred to as the thermal envelope.
- **Conditioned space:** The enclosed space of a house that is heated and cooled ("conditioned") by the heating, ventilation and air conditioning system. For example, the living room, kitchen, bedrooms, and bathrooms are "conditioned space," but the garage is generally not.
- **EF (Energy Factor)**: Measure of the overall energy efficiency of an appliance or system, based on different criteria depending on what is being tested. For example, with water heaters, EF is the ratio of energy received from the water heater to the total amount of energy delivered to the water heater. In terms of energy efficiency, the higher the Energy Factor, the better. (Source: http://www.businessdictionary.com/definition/energy-efficiency.html)
- **HSPF (Heating Seasonal Performance Factor)** : Measure of the heating efficiency of heat pumps; the higher the rating, the more efficient the heat pump. Look for HSPF values of 8.5 or higher for a Florida home. (Note: The cooling efficiency of heat pumps is measured by SEER.)
- **HVAC**: The usual abbreviation for the Heating, Ventilation and Air Conditioning system.
- **R-Valu**e: Refers to resistance to heat flow; a term used mainly in the building industry to describe the insulation properties of building materials. The higher the R-value, the greater the insulation's resistance to heat flow. R-Value is the inverse of U-Factor (U=1/R).
- **SEER (Seasonal Energy Efficiency Ratio)**: A measure of the cooling efficiency for air conditioning units and heat pumps; the higher the SEER number, the more energy efficient the system is in cooling the home's interior air. High efficiency HVAC systems today are generally considered as having a SEER of at least 15 or higher.
- **Solar Heat Gain**: The increase in temperature that results from the sun's radiation.
- **SHGC (Solar Heat Gain Coefficient):** A measure of how well a window blocks heat caused by sunlight. The SHGC measures the amount of the sun's heat admitted by the window, both directly and absorbed (and then subsequently released into your home); expressed as a number between zero and one. The lower a window's solar heat gain coefficient, the less solar heat it transmits. In Florida, select windows labeled with SHGC of 0.40 or less.

- **Solar Orientation**: Orienting the house on the building site to take full advantage of the sun's heat in winter and limiting solar heat absorption in the summer.

- **U-Factor**: Measure of the rate of heat flow (as from your heating system) through a material; in Florida, select windows with a U-factor of 0.65 or less, and make sure the value refers to the *whole window* U-factor.

Where do I start?

All of those terms can look discouraging, but in fact, there is an orderly way to investigate a home for energy efficiency. Using the following text as a guide for forming a checklist, start at the outside of the house, and then work your way to the inside to better assess the home's overall energy efficiency. Doing so may save you time and money. Figure 1 is an example of what your energy efficient home checklist should include. After your initial assessment, however, you may wish to consult with a certified energy rater for professional evaluation of the home's energy efficiency.

The Home Exterior

Florida homes should aim to reduce summer heat gain as the first design priority. Walls facing East and West receive the greatest amount of heat because they receive the direct morning and afternoon sun. Some of that heat is transferred into the home, which means an air conditioner has to operate longer and harder. It is certainly much more energy efficient to stop the heat from entering the home in the first place, rather than trying to cool down a hot interior.

In order for shade trees and other plants to be effective, they must be planted in the right places. The first target areas for shading should be the windows and glass doors in the walls facing West, East, and South. Properly placed tall trees in particular will help shade the roof of a typical single family home, thereby reducing the amount of summer heat infiltrating the home.

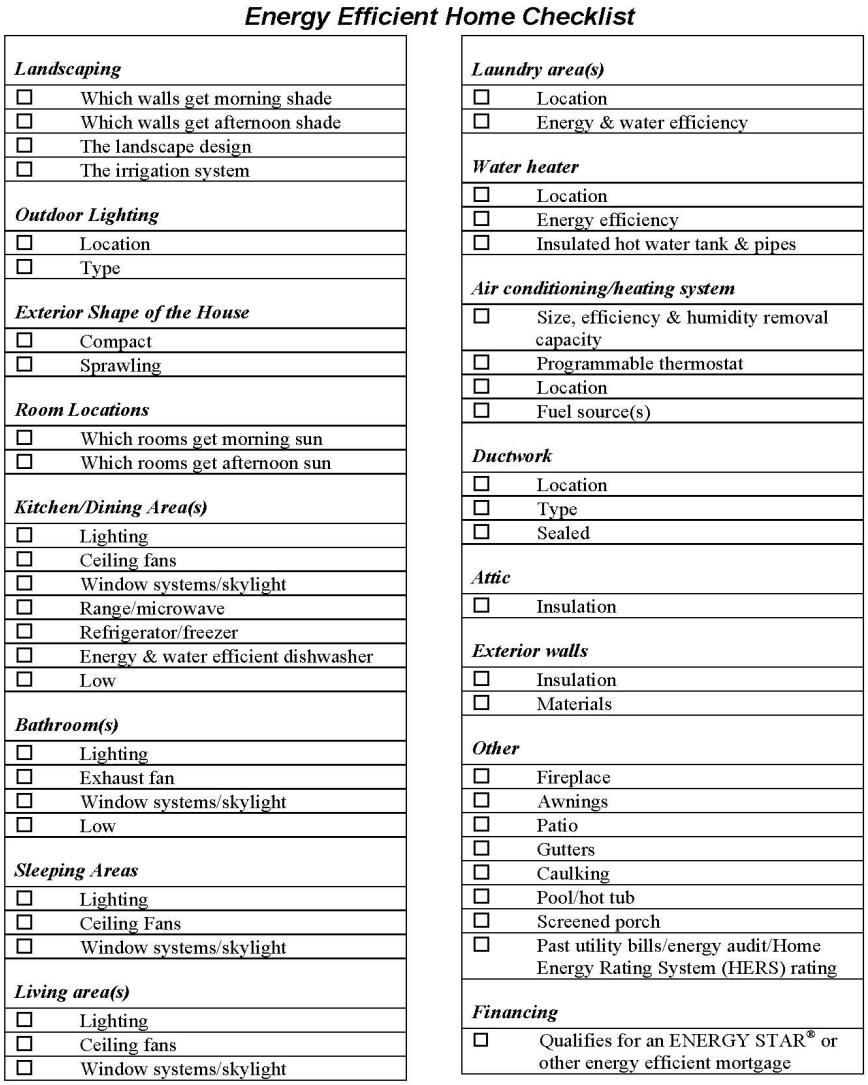
There s more to this cooling effect than simple shading. Plants release large amounts of water from pores in their leaves, and the evaporative cooling creates a zone of cool air around the plant. Look for homes that take advantage of this effect by using plants for shade and wind control rather than less effective fabricated structures such as fences or arbors. Keep in mind that Florida is often affected by hurricane force winds—look for tree species recommended as being wind resistant, and make sure trees are not planted so close to the house that danger is imminent. See the publication *Assessing Damage and Restoring Trees After a Hurricane* at the Web site http://edis.ifas.ufl.edu/pdffiles/EP/EP29100.pdf, which includes a list of wind resistant tree species.

The Building Envelope

Walls: In a home, heat energy is transferred among all materials and substances that are of different temperatures—within the building materials, inside the building itself, and outside the building envelope. (The term “building envelope” refers to all of the external building materials, windows, and walls that enclose the internal space.) Heat moves only when there is a difference in temperature and it always moves from the warm side to the cool side. Heat will continue to “flow” until any touching materials reach the same temperature. However, we usually want the inside of a home to have a different temperature from the outside. Therefore, look for a home designed to minimize solar heat gain.

Compact designs are better than narrow or elongated shapes for several reasons. They gain less heat in the summer (and lose less heat in the winter) through their “skin.” Since a compact shape has a smaller surface area than an elongated one with the same volume, there is less area where the outside temperature wants to balance the inside temperature. They also use fewer building materials and make better use of the same amount of space.

For optimum efficiency, the home should be oriented so that its long axis runs from East to West. In other words, the shortest walls of the home should face East and West, and the longest walls should face North and South. This reduces the total amount of surface area exposed to the summer sun, yet, when needed in cooler regions of the state, allows the low-angle rays of the winter sun to warm the southern exposure (free solar heating, for homes in the cooler parts of the state!).



Energy Efficient Home Checklist

Landscaping	
☐	Which walls get morning shade
☐	Which walls get afternoon shade
☐	The landscape design
☐	The irrigation system
Outdoor Lighting	
☐	Location
☐	Type
Exterior Shape of the House	
☐	Compact
☐	Sprawling
Room Locations	
☐	Which rooms get morning sun
☐	Which rooms get afternoon sun
Kitchen/Dining Area(s)	
☐	Lighting
☐	Ceiling fans
☐	Window systems/skylight
☐	Range/microwave
☐	Refrigerator/freezer
☐	Energy & water efficient dishwasher
☐	Low
Bathroom(s)	
☐	Lighting
☐	Exhaust fan
☐	Window systems/skylight
☐	Low
Sleeping Areas	
☐	Lighting
☐	Ceiling Fans
☐	Window systems/skylight
Living area(s)	
☐	Lighting
☐	Ceiling fans
☐	Window systems/skylight

Laundry area(s)	
☐	Location
☐	Energy & water efficiency
Water heater	
☐	Location
☐	Energy efficiency
☐	Insulated hot water tank & pipes
Air conditioning/heating system	
☐	Size, efficiency & humidity removal capacity
☐	Programmable thermostat
☐	Location
☐	Fuel source(s)
Ductwork	
☐	Location
☐	Type
☐	Sealed
Attic	
☐	Insulation
Exterior walls	
☐	Insulation
☐	Materials
Other	
☐	Fireplace
☐	Awnings
☐	Patio
☐	Gutters
☐	Caulking
☐	Pool/hot tub
☐	Screened porch
☐	Past utility bills/energy audit/Home Energy Rating System (HERS) rating
Financing	
☐	Qualifies for an ENERGY STAR® or other energy efficient mortgage

Figure 1. Sample Checklist Credits: N.W. Taylor et al

Windows: Windows play a large part in comparing homes for energy efficiency because of their potential number, placement, and design. They are usually the weakest points in the thermal envelope, because they easily transmit solar energy. There should be fewer windows on the eastern and western sides of a Florida home, as these areas endure the lengthier exposures to summer sun. Check to see if trees or shrubs, overhangs, porches, or awnings shade these portions of the house. Picture windows should preferably be on the northernmost side of the home, which never or rarely receives direct sunlight. The South side of the home can also have more, and larger, windows, but keep in mind that southern exposure windows will receive increased sunlight

during the winter. For southern parts of Florida, this can be a problem unless the windows are properly shaded.

The Solar Heat Gain Coefficient (**SHGC**) is the amount of solar radiation admitted through a window, both directly transmitted, and absorbed and subsequently released inward. An SHGC rating of 0.80 indicates that the window allows 80% of the solar heat to pass through it. In Florida, where low SHGC is the most important criteria in selecting windows, select windows with an SHGC of 0.40 or less.

The **U-factor** is the window rating that measures heat flow; it may differ for each part of the window. The lower the U-factor, the greater a window's resistance to heat flow and the better its insulating value. Always look for the whole window U-factor, which should be 0.65 or less for Florida.

It's not always possible to learn the SHGC or U-factor of the windows in the homes you're considering purchasing. However, you can determine whether or not the windows are single- or double-paned, and whether or not they shut tightly when closed.

Insulation: One of the most important parts of the building envelope is the insulation. Proper insulation levels throughout the home will reduce the demand for heating and cooling. The U.S. Department of Energy recommends that attic spaces be insulated to R-38, walls to R-13, and raised floors to R-19 in Florida homes. (The attic needs more insulation because the roof receives more direct sunlight, heating up the attic space.) The thickness needed to achieve the recommended R-values will vary, depending on the type of insulation. You can measure attic insulation with a ruler and multiply the number of inches by the R-value of a particular insulation to get an insulation rating. Most important of all, check to see if the insulation has been properly installed, without compression or gaps—check carefully around penetrations for electrical outlets, plumbing and air conditioning. Note that some recessed lights, due to potential fire hazard, should not have insulation in contact with the fixture.

The Home Interior

Heating, Ventilation, and Air-Conditioning (HVAC)

Heating and cooling your home uses more energy, drains more energy dollars, and is more complicated than any other system in the house. Therefore, an HVAC system should be designed, installed, and inspected by a trained professional. Find out the age and—if possible—the efficiency rating of the system; ideally it should be less than ten years old. High-efficiency air conditioning systems should have a seasonal energy efficiency ratio (SEER) of at least 15 or higher, as recommended by the U.S. Department of Energy. Heat pumps should have a heating seasonal performance factor (HSPF) of 8.5 or higher.

Look for the air handler and ductwork to be located inside the house in conditioned space, if at all possible. Central HVAC systems have a component called an air handling unit or AHU (often referred to simply as the “air handler”). The advantages of having the AHU in conditioned space include a more favorable environment, a central location that minimizes duct lengths and optimizes airflow; easier access for maintenance; and any potential leaks that occur take place only in conditioned space. An unpleasant fact is that the duct system nearly always leaks. Leaks in conditioned space are less wasteful than leaks in a hot, uninsulated attic or crawlspace.

See if the home has a programmable thermostat. If used properly—with the temperature set higher when the home is unoccupied in the summer and lower in the winter—this feature can increase the energy efficiency of the system.

Water Heating

After the HVAC system, the second largest energy user within the home is usually the water heater. Conventional water heaters use storage tanks to store hot water that is constantly being reheated—it s easy to see that this can be inefficient. On the other hand, a tankless water heater supplies hot water on demand. Tankless water heaters can be

either electric or gas fired, and are activated by the flow of water when the hot water tap is opened. For more information on choosing the most appropriate type of water heater for your situation, see Energy Efficient Homes: Water Heaters.

Appliances

An energy efficient home should have ENERGY STAR® rated appliances including the clothes washer, dishwasher, refrigerator, freezer, and ceiling fans. Look for the EnergyGuide label on appliances and other items in order to compare products. For more information, see the Web site http://www.energystar.gov/index.cfm?c=appliances.pr_appliances for ENERGY STAR® appliances, and http://www1.eere.energy.gov/consumer/tips/energyguide.html for EnergyGuide labels. Also, use the publications Energy Efficient Homes: Appliances in General and Energy Efficient Homes: The Laundry Area.

Summing It All Up

There are many important factors to consider when purchasing a home. Buying an energy efficient home is a top priority and a long-term investment that will reward the homeowner with reduced energy costs. It is important to compare the energy efficiency of homes before making a final purchase. This is an overview of what to look for when comparing homes for energy efficiency. For more information on the various items mentioned, see the other fact sheets in this series available online at http://edis.ifas.ufl.edu/TOPIC_SERIES_Energy_Efficient_Homes.

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University of Florida Energy Efficient Building Construction in Florida, SP 267, Gainesville, FL. http://www.aceee.org/consumerguide/cooling.htm

Table 1. Basic Rules of Thumb for Energy Efficient Home Design in Florida

Orientation	• Longest walls face north and south • Shortest sides face east and west • Compact, rather than sprawling design
Shading	• Longer roof overhangs and porches on east and west faces • Landcaping used to shade the home effectively

Table 2. Rules of Thumb for HVAC Systems

Efficiencies	• HVAC: SEER of 15 or higher • Heat pump: HSPF of 8.5 or higher
Location	• Air Handler in conditioned space • Ductwork in conditioned space

Table 3. Basic Rules of Thumb for the Building Envelope

Insulation	• Minimum R-38 for attics • R-13 for walls, and R-19 for raised floors
Windows	• Double paned • SHGC of 0.40 or less • Correctly placed to avoid excessive solar heat gain: 1. More, and larger, windows on the North side 2. Fewer, and smaller, windows on the East and West sides 3. East and West windows should be shaded