Chapter 10

Energy-Efficient Appliances

Recommendations	First Cost	% Estimated Savings on Utility Bill
1. Choose an efficient water heater and insulate hot water pipes.	S/M	5-20
2. Choose highly efficient kitchen and laundry appliances.	S/M	2-10
3. Locate clothes washer, dryer and water heater in an unconditioned space.	R	0-5
4. Use efficient lighting.	S	0-5
5. Install water-saving shower heads and toilets	S	0-5 (Energy bill) 20-30 (Water bill)
Maximum Combined Total	M	30

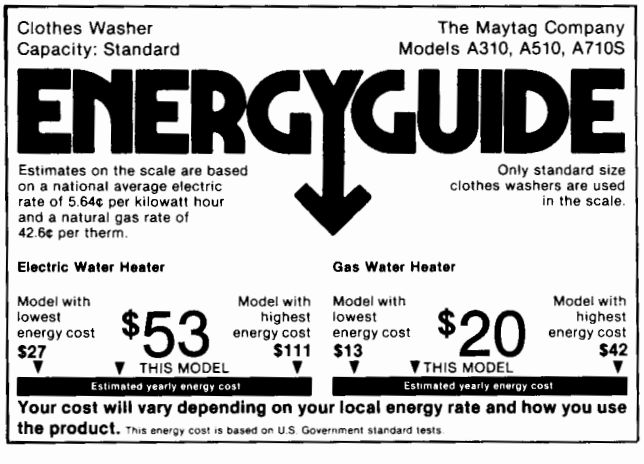
Cost Codes:
R = reduced
N = negligible
S = small (<$0.25/ft² of floor area)
M = medium (>$0.25 and <$1.00/ft² of floor area)
H = high (>$1.00/ft² of floor area)

Marketing Energy-Efficient Appliances

Many home builders adopt a "lowest-cost" attitude, selecting appliances which are least expensive at the time of purchase. If you were buying a refrigerator, stove, washing machine or other major appliance for your own use, you'd want to consider what it will cost to operate over its lifetime. Extend that same concern to your home buyers. By installing more efficient and better-made appliances that will last longer and save substantial money during their lifetime, you make your homes more marketable and distinctive.

Quite often, the initial extra cost of energy-efficient appliances is moderate and should not greatly raise the home's price. You can usually justify whatever increase is necessary by showing a prospective purchaser the life-cycle cost estimates you have prepared for the home's major appliances. This information will reveal how much the appliance will cost to operate over its lifetime, including expenses for maintenance and energy. The savings will be readily apparent.

Energy information is presented on the labels affixed to refrigerators, refrigerator/freezers, freezers, water heaters, clothes washers, dishwashers, and room air conditioners. Federal law requires that "EnergyGuide" labels give the average yearly operating cost and comparison information relative to other comparable models. A yearly cost table allows you to estimate the annual operating costs based on varying utility rates.



Use EnergyGuide labels to promote your appliances.

The life-cycle costs of two different appliances can be calculated by using the following formula:

Life-cycle cost = purchase price + (annual energy cost x estimated lifetime x discount factor).

The discount factor is a number that adjusts for inflation and takes into account the fact that today's dollar is more valuable than a future dollar (since today's money could be invested and earn interest over time). Discount factors are given in the table below.

Appliance Information for Life-Cycle Cost Comparisons

Appliance	Average Lifetime (years)	Discount Factor
Refrigerator/freezer	20	0.76
Freezer	20	0.76
Central air conditioner	12	0.84
Clothes washer	13	0.83
Clothes dryer	18	0.78
Dishwasher	12	0.84
Electric water heater	13	0.83
Gas water heater	13	0.83
Range/oven	18	0.78

Note: The discount factors here are based on a discount rate of 5% and an energy price escalation rate of 2% per year above inflation.

Chart is courtesy of Massachusetts Audubon Society and the American Council for an Energy-Efficient Economy. Gas water heater information supplied by City of Tallahassee Energy Services.

Example

Consider two refrigerators with different efficiencies. By comparing the EnergyGuide labels, you may find that Model A, which sells for $800, has an estimated annual operating cost of $100. Model B sells for only $700, but will cost $130 a year for electricity. The discount factor for this appliance can be figured at 0.76. (See the table above for numbers for other appliances, along with an explanation of the discount rate.)

By using the formula given above, you find the Model A refrigerator will have a lifetime operating cost of $1520 (a total life-cycle cost of $2320), while Model B, which cost only $100 less initially, has a lifetime operating cost of $1976 (a life-cycle cost of $2676). Most consumers would gladly pay $100 more for Model A to save $456, or almost 25% in energy costs, over its lifetime.

If you are reluctant to purchase high-efficiency models of all the appliances for your homes, at least buy highly efficient water heaters, refrigerators and freezers. These appliances consume a great amount of energy, so they offer greater potential savings and in most cases are very cost-effective.

You can further promote highly efficient appliances by comparing their efficiencies to national standards established by Congress. Ask your reference librarian or local congressman for a copy of Public Law 100-12-March 17, 1987, which contains these standards. If your efficiencies exceed the legislated standards, point out how you are ahead of the builders who merely *meet* them.

When you purchase efficient appliances, be sure to feature this in your promotional material. If electrical equipment has been tested by Underwriter's Laboratories, Inc., or gas equipment certified by the American Gas Association, you have seals and certificates which can be prominently displayed in your model homes to show that your appliances comply with national safety and efficiency standards.

Low-cost publications available from major national associations contain detailed energy information you can use in choosing and marketing appliances. Contact the organizations listed in the "For further information" section at the end of the chapter.

Also promote toilets and showerheads that demand very little water. In many communities, these features can be an easy sell because water and sewer rates have skyrocketed in recent years. Consumers will appreciate the effect of reduced water use on household expenses, and at the same time feel good about helping to conserve our natural resources.

Selecting and Installing Energy-Efficient Appliances

1. Water heating options

Water heating is the second largest user of energy in Florida homes, making up 23 percent of the utility bill. This percentage translates to an average electrical cost of $150 to $380 per year, depending upon hot water usage, fuel costs and unit efficiency. Choice of a water heater is one of the most important a consumer can make, since the selected option will have such a direct effect on the buyer's monthly energy cost.

Before discussing water heating options, water conservation must be mentioned. The best way to save on water heating is to use less hot water. In Florida residences, a family of two will typically use 40 gallons of hot water per day; a family of four will consume about 70 gallons. Homebuyers and their builders can take steps to minimize hot water consumption. Clothes should be washed in cold or warm water instead of hot water. The hot water tank thermostat should be set at the lowest satisfactory temperature. If the family needs hot water only for a few hours a day, an automatic timer may be installed, setting the timer to allow the heating element to come on just prior to the needed hours. Timers may also be of added benefit if peak-load pricing of electricity is available. Builders should insulate hot water pipes and install low-flow showerheads. These simple measures cost very little but can save from 15% to 25% of the energy otherwise used for heating water.

Five types of water heating systems are available for Florida homes — electric resistance, waste heat recovery, heat pump water heater, solar and gas. The following sections explain each of the five water heating options. To make the best decision on a water heating option, the advantages and disadvantages of each, as well as its cost, performance and maintenance requirements, must be carefully considered.

Electric Resistance Water Heaters. The most commonly installed type of water heater is the electric resistance unit because of its low purchase price and ease of installation. However, electric ater heaters cost more in energy charges than any of the other options. Uncertainty in the future price of electricity makes the option even less desirable. The cost of installing a new electric resistance heater will vary from $150 for a very energy-inefficient model (not recommended) with an energy factor (EF) of 0.75, to $350 for an efficient model with an EF of approximately 0.88. For electric resistance water heaters, the EFs range from 0.74 to 0.97, with the higher the EF, the more efficient the unit. For an electric resistance unit, you can calculate its yearly cost to operate based on the following formula:

Cost = 0.89 (gal/day)(water temperature rise - F°) (Electricity cost -$/kWh)/EF

For a sample computation, assume a hot water temperature of 122°F and incoming water temperature of 72°F, a daily water consumption of 70 gallons, a heater with an EF of 0.88, and electricity costing $0.08 per kWh. The annual electricity cost is then:

Cost = 0.89(70)(122-72)(0.08)/0.88 =$283/year

Heat Recovery Water Heating. An alternative for water heating is a heat recovery unit (HRU). An HRU operates only in conjunction with a central air conditioner or heat pump and uses heat discharged by these systems to heat water. The system works like this: super-heated refrigerant from the air-conditioning system enters the heat recovery system's heat exchanger. Cool water from the water storage tank circulates through the heat exchanger, where a large amount of the air conditioner's exhausted heat is captured and then transferred to the water. The heated water is then pumped back into the water storage tank and is ready for use.

An HRU will cost from $600 to $1,000. If the home is air conditioned five to seven months per year, a heat recovery unit could save from 20 to 50 percent on annual water heating energy costs. Savings will depend upon hot water usage and maintenance costs. One drawback of these units is that they work best with less efficient air conditioners, but a benefit is that they increase the operating efficiency of the air conditioner itself.

Installation is an important consideration for an HRU. Contract only with experienced installers of these systems, since improper installation can minimize the effectiveness. Also be sure that the central air conditioner or heat pump warranty will not be voided by adding HRU equipment. In order to receive Energy Code points, the HRU must be tested according to ARI Standard 470-80, with Florida regulatory modifications.

Heat Pump Water Heating. Two factors have kept heat pump water heaters from gaining more popularity — their relatively high initial cost ($900 to $1100) and their newness in the market. Installed and operating correctly, these systems use about half the energy of conventional electric resistance models.

A heat pump water heater takes heat from the air and pumps it into a tank filled with water. There are two types: integral and remote. The integral heat pump has its own water tank, while the remote unit is connected to an existing electric unit. Both systems use a resistance element for backup needs. Maintenance requirements for the best units should be similar to those required by heat pumps used for space conditioning. Because of the way the technology developed, most heat pump units are sold through air conditioning distributors rather than conventional plumbing supply companies.

For extra savings, select a unit that in summer permits air to be drawn from the house and returned (much cooler) to the house. In winter the air should be drawn from and returned to the outdoors.

Solar Water Heating. A solar water heater uses the sun's energy rather than electricity or gas to heat water. In Florida, the most widely used type of solar water heater — a pumped system — circulates potable water from the water-storage tank through one or more solar collectors and back into the tank. A controller regulates the circulating pump, turning it on when there is enough solar energy to heat the water. A backup electric element heats the water during periods of insufficient sunshine or high hot water demand. See pages 10-7 and 10-8 for a detailed discussion of the different types of solar water heating systems. For Florida residences, a rough rule of thumb for the size of the solar system is 10 to 15 square feet of solar collector area per person and 20 gallons of water storage per person. Thus, for a family of four, 40 to 60 square feet of collector and an 80-gallon storage tank are typical. Monthly savings will depend on hot water consumption, solar energy system size, and type and price of fuel used for backup. A solar water heater can save between 50% and 85% of the hot water portion of the monthly electric utility bill, or $12-$24 per month for a family of four if the backup element is kept at 122°F. A solar water heater can save even more if the backup is turned off and the homeowner relies solely on the sun for hot water. During the summer months, when hot water demands are lower and the sun shines longer, most solar owners turn off the backup and still get plenty of hot water.

Gas Water Heaters. Gas water heaters cost a little more to purchase than do electric resistance units, but they offer an excellent operating cost advantage at the present cost of natural gas. Rebates from gas utilities also can make the initial cost lower. To compute the annual cost of natural gas heating, use the following formula:

Cost=(0.03)(gal/day)(Water temperature rise-F°) (gas price - $/therm)/EF

For gas heaters, the range of EFs is larger than electric resistance and can vary from 0.40 to 0.63. As an example, consider 70 gallons per day, a hot water temperature of 122°F and incoming water temperature of 72°F, with natural gas costing $0.60 per therm and EF equal to 0.55. The fuel cost will be:

Cost = (0.03)(70)(122-72)(0.60)/(.55) = $115/year

For propane gas at $1.10/gal, it will cost $229/year.

Comparing Options. Any comparison of options is difficult because of the many variables involved — hot water usage, unit efficiency, fuel costs, water temperatures, initial purchase price, and operation and maintenance costs. In addition, if life cycle costs are considered, then estimates must be made of fuel escalation and inflation and discount rates.

To provide a simple comparison of the different options, the table on page 10-6 was constructed to compare the water heating options with electric resistance heating. The first column shows the range of initial purchase prices, and the last three columns show savings for each option (vs. electric resistance). The range of values are for different unit efficiencies.

There are many advantages to the home buyer when a nonelectric resistance water heating system is installed during construction. One of the most significant is the economic benefit over the life of the system. For example, the bulk of the cost of a solar water heating system occurs at the front end, as opposed to its electric counterpart, which has fuel costs that escalate during the life of the system. The home builder who offers a solar water heating package could give clients a positive cash flow on water heating costs from day one of occupancy. Including the cost of the solar system in the mortgage (as with other appliances) will allow the home owner to pay for the system through monthly energy savings. For

Annual Energy Savings Comparison: Alternative Water Heating Options and Electric Resistance

Type of Water Heating	Retail System Price	40 Gal per Day Use	70 Gal per Day Use	Percent Savings
Electric Resistance	$150-$350	—*	—*	—
Heat Recovery Unit	$600-$1000	$32-$95	$57-$166	20-50%
Heat pump	$900-$1100	$65-$95	$113-$166	40-50%
Solar	$1500-$2500	$81-$162	$142-$282	50-85%
Natural Gas	$350-$450	$97-$125	$168-$217	59-65%

*Electrical resistance heating values are calculated using the formula on page 10-4 and EF values of 0.75 and 0.88. These calculations assume annual electrical costs of $162 to $190 for 40 gpd and $283 to $332 for 70 gpd usage.

example, if the system costs $2,000, is 80% financed and is amortized over 30 years at 10.5 percent interest, the monthly payment will be $14.64. In addition, the interest is tax deductible. At present, the typical monthly energy savings from the solar system will vary from $12 to $24 per month for a family of four and will increase as energy costs rise.

Instantaneous Water Heating. Instantaneous water heaters are powered by gas or electricity. The heating source turns on when the faucet, shower, or dishwasher demands hot water. These types of water heaters are typically used in residences where hot water usage points are separated by long distances or in homes which would normally require two separate hot water storage tanks. Its advantage is that no storage tank is required.

An electric unit heats water where hot water is needed; typically one unit is placed in the kitchen and another in each bathroom. The advantages of the electric unit are that the hot water pipes are eliminated throughout the house, and hot water arrives very rapidly when demanded. A disadvantage of the electric instant water heater is that it requires a large amount of power (5 kW to 9 kW) for each unit. If residential electric rates have peak demand charges these type of units could cause heavy cost penalities and home owners may have to adjust their water-use habits.

Instantaneous gas heaters typically provide hot water to the whole house. Thus, the input rating is much higher than the normal gas water heater storage unit. These units should be located in nonconditioned space.

2. Choose efficient kitchen and laundry appliances

Except for mortgage payments and possibly food bills, the energy used to run the home's space conditioning equipment and appliances is the costliest single household expense. Consider the electricity costs to operate these major home appliances for one month:

- $6 for a clothes dryer
- $16 for a large frost-free refrigerator/freezer
- $25 or more for an electric resistance water heater for a family of four.

Since the electricity to run a refrigerator for 15 to 20 years can cost three times as much as the unit's original purchase price, you can see the impact of appliance efficiency on your clients' pocketbooks.

The growth of consumerism has pushed manufacturers to upgrade their products, resulting in appliances that are far more efficient than those produced just a decade ago. Since builders usually can obtain good discounts from manufacturers and distributors, you should be able to install highly efficient appliances in your homes at little extra cost—but with more profit in your pocket.

According tothe Association of Home Appliance Manufacturers, electricity use has decreased for today's appliances as compared to similiar appliances in the early 1970s. For example:

- Clothes washers use 32% less energy.
- Dishwashers use 34% less energy.
- Freezers use 46% less energy.

The American Council for an Energy-Efficient Economy provides annual energy usage and costs for the most efficient products on the market.

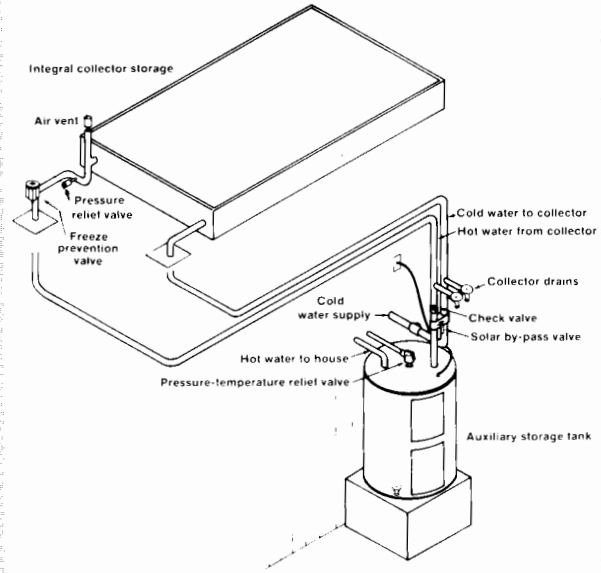
What is the difference in solar systems?

Available solar water heating systems differ in their methods of controlling the pump (if there is one), freeze protection, ease of installation, efficiency and cost. The order in which they are discussed here is from the simplest to the most complex.

Integral Collector Storage (ICS) System. An ICS system (also called breadbox or batch system) can provide reasonably hot water or serve as a cost-effective preheater for a conventional heater.

The hot water storage system is part of the collector. Cold water flows progressively through one or more tanks where it is heated by the sun. Hot water is drawn from the hottest tank at the top, and is replaced by city supply water entering the lower tanks. Pumps and controllers are not required. On demand, hot water from the collector flows to a standard hot water auxiliary tank within the structure.

This type of unit will perform best in warmer weather and with mostly afternoon or evening water use. Its simple design should allow any plumber to install it. However, due to the weight of 30 or 40 gallons of water on the roof, plan to strengthen the roof support under the collector.



Integral collector storage system.

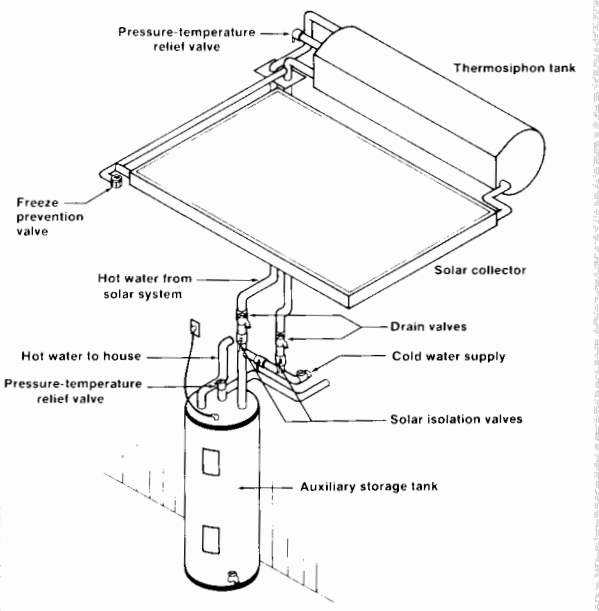
The average cost to a builder of an ICS system, including installation, is about $1500 to $2000.

Thermosiphon System. This system was widely used in the early days of solar water heating in Florida. It is automatic, simple and reliable.

As the sun shines on the collector, the water inside is heated. Gravity then pulls denser cold water down from the tank and into the collector inlet. The cold water pushes the less dense heated water through the collector outlet and into the top of the tank. This continuous action provides a tank full of hot water at the end of the day.

Neither a pump nor controller is needed. Cold city water flows directly to the tank on the roof. Solar-heated water flows from the rooftop tank to the ground-level auxiliary tank whenever water is drawn.

A thermally operated valve is sometimes provided to protect the collector from freezing. Manual draining is suggested as a backup.



Thermosiphon system.

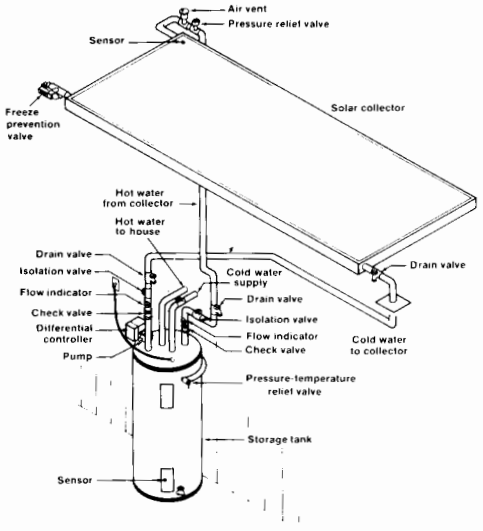
The average cost to the builder, with installation, is about $1800 to $2500.

Direct Pumped System. This is the type of system most common in Florida. The sun's heat is transferred directly to the potable water circulating through the collector tubing and storage tank; no antifreeze solution or heat exchanger is involved.

Different solar water heating systems (continued)

Typically, a controller turns on the pump when the collector is 20°F warmer than the tank water. It turns off the pump when the difference is less than 5°F. In some systems, the controller is replaced by a photovoltaic panel which varies the pump speed in proportion to the solar intensity. Appliance timers may also be used to control system operation.

Freeze protection is achieved by automatic recirculation of tank water when the collector falls below 42°F or so, or by dribble valves which open when the collector approaches freezing.



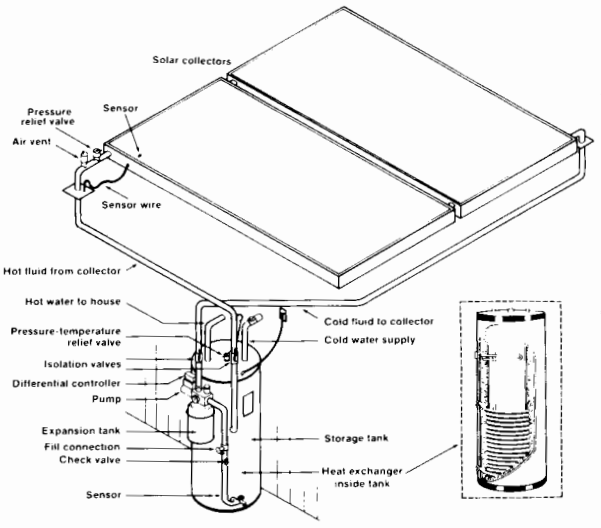
Direct pumped system.

The average installed price to builders is about $1700 to $2500. However, the builder will save the $200 to $300 cost of a conventional water tank.

Indirect Pumped System. This closed-loop system is common in northern Florida, where freezing weather is more frequent. An antifreeze solution circulates through the collector, and a heat exchanger transfers the heat to the tank water.

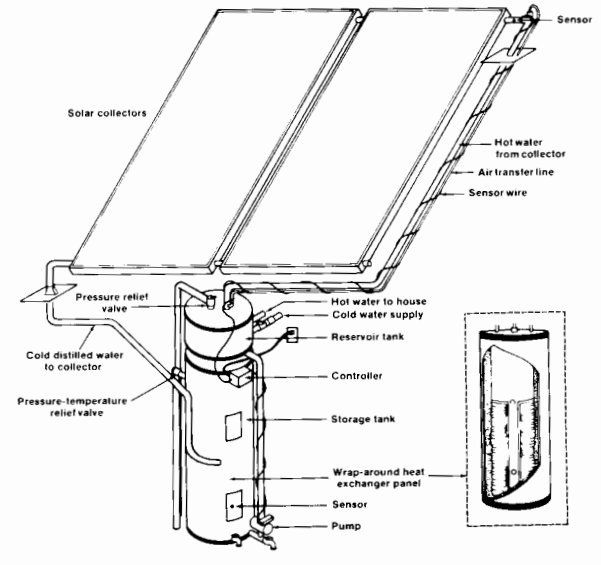
In conjunction with collector and tank temperature sensors, a differential controller determines when the pump should be activated to pump the heat transfer fluid through the collector.

The average cost, including installation, is about $2000 to $2500. However, the builder will avoid the $200 to $300 cost of a conventional water tank.



Indirect pumped system.

Drain-Back System. A major design feature of the drain-back system is fail-safe freeze protection. When the system is not collecting heat, water in the collectors and exposed piping drains into an insulated reservoir tank. The slight tilt of the collectors allows complete drainage. The fluid used in this system is either distilled water or a mixture of distilled water and antifreeze.



Drain-back system.

Average installed cost: about $2000 to $2500, minus cost of a conventional water tank.

Refrigerators. The typical refrigerator with top-mounted freezer and automatic defrost now uses about half of the energy a comparable model used just 15 years ago. Models with side-by-side freezers use more energy than those with top-mounted freezers, and energy use increases with refrigerator size.

Comparison of Refrigerators

Type of Refrigerator	Energy Use & Energy Cost kWh/yr (@8.0 cents/kWh)	
	Lowest	Highest
Single-door, manual defrost		
12.5-14.4 cu. ft	504 ($40)	693 ($55)
Top freezer, partial automatic defrost		
12.5-14.4 cu. ft	730 ($58)	819 ($66)
Top freezer, automatic defrost		
12.5-14.4 cu. ft	819 ($66)	1360 ($109)
14.5-16.4 cu. ft	770 ($62)	1452 ($116)
16.5-18.4 cu. ft	768 ($61)	1272 ($102)
18.5-20.4 cu. ft	844 ($68)	1348 ($108)
20.5-22.4 cu. ft	948 ($76)	1481 ($119)
22.5-24.4 cu. ft	978 ($78)	1524 ($122)
Side-by-side freezer, automatic defrost		
18.5-20.4 cu. ft	1159 ($93)	1713 ($137)
20.5-22.4 cu. ft	1156 ($92)	1807 ($145)
22.5-24.4 cu. ft	1222 ($98)	1914 ($153)
24.5 cu.ft & larger	1319 ($105)	2933 ($235)

Freezers. Chest freezers are generally more efficient than upright models, and manual defrost models use less electricity than those with automatic defrost.

Comparison of Freezers

Type of Freezer	Energy Use & Energy Cost kWh/yr (@8.0 cents/kWh)	
	Lowest	Highest
Upright, manual defrost		
11.5-13.4 cu. ft	578 ($46)	1022 ($82)
13.5-15.4 cu. ft	652 ($52)	1096 ($88)
15.5-17.4 cu. ft	617 ($49)	932 ($75)
17.5-19.4 cu. ft	730 ($58)	1071 ($86)
19.5-21.4 cu. ft	785 ($63)	1067 ($85)
Upright, automatic defrost		
13.5-15.4 cu. ft	652 ($52)	1141 ($91)
15.5-17.4 cu. ft	882 ($71)	1474 ($118)
17.5-19.4 cu. ft	1108 ($89)	1285 ($103)
Chest, manual defrost		
13.5-15.4 cu. ft	428 ($34)	743 ($59)
15.5-17.4 cu. ft	430 ($34)	578 ($46)
17.5-19.4 cu. ft	607 ($49)	993 ($79)
19.5-21.4 cu. ft	529 ($42)	882 ($71)

Dish and Clothes Washers. The information below on dishwashers and clothes washers is based on average usage when connected to an electric resistance water heater. Since most of the energy used by these appliances is for heating water, installing an efficient water heater along with an efficient dishwasher and clothes washer can save the home owner considerable money. Dishwashers with built-in heaters permit lower settings for the hot water tank thermostat and offer even more savings.

The top-rated dishwasher uses 574 kWh per year, for an annual energy cost of $46.

The most energy-efficient compact clothes washer (less than 16 gallons capacity) uses 623 kWh for an annual energy cost of $50. A front-loading standard-size model uses 451 kWh ($36 energy cost) and a top-loading model uses 651 kWh ($52 energy cost).

Clothes Dryers. A gas unit may save 50% of the cost of drying clothes with an electric unit. Regardless of your choice, make sure the dryer is vented to the outdoors.

3. Locating appliances

Appliances which give off considerable heat should be placed in nonconditioned spaces. The best locations for a clothes washer, clothes dryer and water heater are in a garage, in a nonconditioned utility room, or, for a multifamily dwelling, in a closet off the porch. As noted above, vent the dryer to the outdoors. Use of a pressure-activated damper is recommended.

If laundry areas are to be located in an enclosed area other than a garage, install a vent fan (like a bathroom fan) to the outdoors. The fan will prevent moisture buildup. See fan recommendations in Chapter 9.

A refrigerator puts out a fair amount of heat, so do not place it where the heat will remain trapped. The refrigerator will have to work harder to overcome the heat, driving up the energy usage. Leave a 6-inch space between the wall and the unit. An added suggestion: Locating an extra air-conditioner vent near the refrigerator may reduce its running time, thereby reducing the load on the air conditioner. Inform clients that the grille must be shut in winter when the heater is used so that the refrigerator will not have to work harder then.

4. Lighting options

The effective use of home lighting is important for both economic and task-related reasons. Lighting can account for about 5% of a home's energy use.

The quality and quantity of light affects the home's security and atmosphere and the performance of such basic activities as reading, study and conversation.

The efficiency, in lumens (a measurement of light quantity) per watt of electricity, of different types of lighting is given in the table below.

The most common artificial light source is the incandescent light bulb. It is relatively inexpensive and gives a natural appearance to the objects it illuminates. However, almost 90% of its power is wasted as heat (creating an additional load on the air conditioner in the summer). Standard light fixtures decrease a bulb's light output even further. Use light fixtures which allow light to flow unhindered into the living space, and install soft (reduced glare) bulbs or clear bulbs with diffusers in the fixtures.

Because incandescent bulbs usually burn out after about 750 hours of use, the average family spends around $10 a year to replace them — in addition to about $100 a year for the electricity they consume.

Do not use four- or five-bulb incandescent fixtures. The bulbs may create an unwanted 200- or 300-watt space heater whose output can be very annoying, especially in a small space like a bathroom.

Fluorescent. Fluorescent lamps offer an alternative for builders interested in lowering the home owner's lighting costs. These lamps, used commercially for many years, require only one-fourth the electricity needed to power an incandescent bulb. The standard fluorescent lamp has been kept out of most home uses because of its shape, the unattractiveness of its fixture, its tendency to flicker, and the unflattering color of its light.

Lighting manufacturers have now introduced a compact screw-in fluorescent bulb which offers the energy economy of the older fluorescent type and lasts 10 to 12 times longer than an incandescent bulb. It can give up to 10,000 hours of use. Also, it produces equivalent light with far less heat. Placed in a kitchen or bathroom, these bulbs can pay for themselves in about three years.

Most new fluorescent bulbs have no noticeable flicker or hum, and provide light that is neither harsh nor abnormal in color. However, they typically take from several seconds to a couple of minutes to come to full brightness, making them unsuitable for applications where immediate light is needed (such as for stairway illumination).

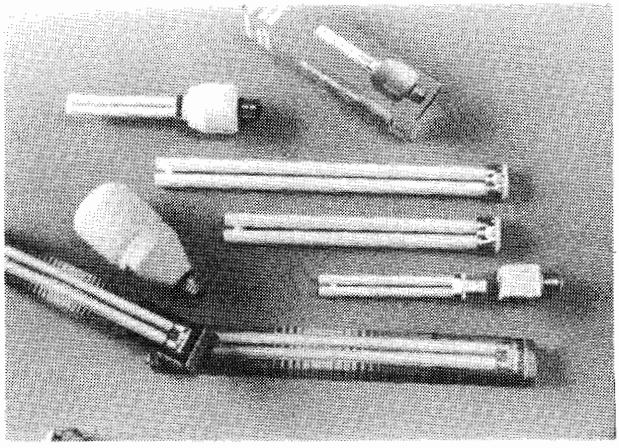
Halogens. Another alternative growing in popularity is the halogen lamp, which is less efficient than the compact fluorescent but is still about 20% more efficient than incandescent bulbs. Hologens bulbs give a sharp, controlled light beam, and builders are using them in track fixtures to allow the exact focusing of light.

Light Source Characteristics

Light Source	Lamp Efficacy (lm/watt)	Mean Lifetime (1000 hrs)	Initial Cost	Life-Cycle Cost	Lamp Color	Start Time	CRI	Restart Time	Available Wattage
Incandescent and halogen	4-30	0.5-3	low	high	reddish	inst.	93	inst.	60-1500
Fluorescent	28-120	8-28	med	med	bluish white	rapid	82	rapid	40-125
Mercury vapor	23-46	16-24	high	med	bluish	5 min	NA	NA	50-100
Metal halide	50-90	10-20	high	med	white	5 min	NA	NA	175-1500
High-pressure sodium	46-120	10-24	high	low	yellow	NA	NA	NA	35-1000
Low-pressure sodium	60-160	10-18	high	lowest	yellow-orange	NA	NA	NA	18-180

Color. When choosing bulbs of any type, check the *color rendering index* (CRI) on the box. The CRI is a measure of how well the bulb defines colors and how closely an illuminated object's color will resemble its color in daylight. Most compact fluorescents have a CRI of around 82, a little less than incandescents, which have a CRI of about 93. The closer to 100, the more natural objects will appear. Select tubes coated with rare-earth phosphors for the most accurate colors.

Bulb color temperature also can help you make your purchase decision, since it gives an idea of how the light will look. Lights with lower temperatures tend to have a reddish-yellow appearance, while those with higher temperatures look bluish. Where the bulbs will be used, how often they are turned on, and other general lifestyle factors help determine the appropriate type.



Compact fluorescents can be used for many lighting applications.

Daylight. Keep in mind that the need for electric lighting is strongly affected by the use of daylighting in the home. Your choice of such passive building strategies as clerestory windows and shaded, glare-free window areas can minimize the need for electric lights. Also, you can install dimmers (choose solid-state ones) and other controls which permit the occupants to use only the amount of electric light they need.

Outdoor Lighting. When choosing outdoor lights for the home, consider using the new photovoltaic-powered (PV) lights. A number of manufacturers offer low-cost systems well-suited for such low power uses as home walkways and landscaping. The lights add a high-tech, modern look to the home, and will capture the attention of your prospective buyers. Most available units have storage batteries that can power the lights from three hours to all night long, and provide that power for two or three days if the weather is cloudy. The lights are simply pushed into the ground and need no electrical line installation. It is important to use efficient (not incandescent) bulbs in these fixtures to achieve the desired quantity of light at a reasonable cost. Contact the Florida Solar Energy Center for a listing of PV dealers and manufacturers.

For brightly lit outdoor spaces like patios, consider efficient low-pressure sodium, mercury vapor or fluorescent lamps. These units will provide the needed light more efficiently than incandescent lamps.

Aid to Selection. With so many new types of bulbs available, making the right choice isn't always easy. An informative booklet called "Lighting Your Life" offers helpful suggestions for comparing various types of light sources. For a copy, send $1 to the American Home Lighting Institute, 435 N. Michigan Ave., Suite 1717, Chicago, IL 60611.

5. Bathroom Fixtures

The fixtures you install in the bathroom especially affect the home owner's water bill. Some water rates in Florida have increased as much as 400% in the last 15 years! Toilets can account for 40% of the water used in a home.

Toilets in most older homes use 5 or 6 gallons per flush. While the state plumbing code requires 3½ gallon toilets, new toilets are available that use from one quart to 1½ gallons per flush and perform as well or better. Many of the ultra-low-water toilets on the market are stylish European models. Installation is easy, although slightly different than for conventional toilets.

Shower faucets are another potential water saver. Conventional ones permit a water flow of 5 to 10 gallons a minute, accounting for up to 30% of the water used in the home. Some showerheads on the market will reduce that to 1½ to 3 gallons per minute (gpm). State law requires that all showerheads in new construction be 3 gpm or less. A good showerhead not only saves water but reduces hot water demand and its associated energy use. The home owner will want a comfortable shower with adequate temperature and water force. Some water-saving units produce a mist that reduces the water

temperature, while others do not feel forceful enough. Consult articles in consumer magazines for information on which showerheads to buy. If you've narrowed your choice to several models, test them yourself. Additional benefits from using water-conserving fixtures may include down-sizing a septic tank or paying reduced impact fees to hook up to a sewer system.

Summary

Growing consumer interest in efficient appliances can make a small extra investment on your part an important marketing aid. Even when the extra costs of efficient appliances are built into the home's price, consumers can easily see how monthly savings outweigh higher mortgage payments. A profitable marketing strategy is to offer these appliances as part of an energy option package.

Selecting energy-efficient water heaters and refrigerators can mean significantly lower utility bills. Water heaters and washers and dryers should be located in the garage or other nonconditioned space. New choices in lighting, toilets and showerheads can also reduce utility bills.

For further information

"Water-Saving Toilets." Carl Lowe, *New Shelter* (now *Practical Homeowner*) August 1986.

Air-Conditioning and Refrigeration Institute (1501 Wilson Blvd., 6th Floor, Arlington, VA 22209-2403) publishes directories of certified products and general interest material.

The American Council for an Energy-Efficient Economy (1001 Connecticut Ave., N.W., Suite 535, Washington, D.C. 20036) publishes a guide to the top-rated appliances twice each year.

The Association of Home Appliance Manufacturers (20 North Wacker Drive, Chicago, IL 60606) publishes energy information on refrigerators, freezers and room air conditioners, along with general fact sheets on saving energy.

The Gas Appliance Manufacturers Association, Inc. (P.O. Box 9245, Arlington, VA 22209) publishes informative materials and product directories.

"Amendment to the Energy Policy and Conservation Act with respect to energy conservation standards for appliances," 100th Congress, Public Law 100-12-March 17, 1987.

Florida Solar Energy Industries Association, 1732 N. County Road 427, Longwood, FL 32750, (407) 260-0770.

Association of Refrigerant Desuperheater Manufacturers, 2469 Aloma Ave., Suite 220, Winter Park, FL 32792.

"Residential Conservation Demonstration, Domestic Hot Water," Final Report, FSEC-CR-90-83, Tim Merrigan, 1983.