

# Buying an *Energy-Efficient* Refrigerator

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The Kenmore #74982 (shown) and #74282 models provide ample space and excellent energy values.

In most households, refrigerators consume more energy than any other use except heating, air conditioning, and hot water. For on-grid utility customers looking to save energy on refrigeration, the choice is pretty straightforward. New Energy Star refrigerators provide energy savings by using high-efficiency compressors, improved insulation, and more precise temperature and defrost mechanisms that improve energy efficiency.

Today's Energy Star models use about half the energy of refrigerators manufactured before 1993, about 40 percent less energy than conventional models sold in 2001, and at least 15 percent less energy than required by current federal standards. Replacing a 15-year-old refrigerator with a new Energy Star model can save enough energy over the course of a year to light the average household for more than four-and-a-half months, and can eliminate more than 400 pounds (180 kg) of pollution each year.

Buying an efficient refrigerator should be as easy as 1-2-3. First, do your homework. Next, do some "preshopping." Then bring home a refrigerator that will serve your needs, save pounds of pollution every year, and keep dollars in your pocket instead of the utility's.

## *Space Has Value*

Refrigerator space can be given a specific value in dollars per cubic foot of chilled space per year. The comparison table in this article of selected models

displays this value as a factor of the purchase cost, spread over the appliance's expected life, plus the cost of electrical energy.

Analyze your refrigerator space needs. Over the decades, although their efficiency has increased, refrigerators have become bigger and bigger—and more space costs money to build, to heat, and to cool. Is your need for space a matter of necessity, convenience, or just habit? Many individual factors, including things like root cellars and distance to grocery shopping, can influence your need for space.

### Features

Decide what style and features you want, but consider that many features will use extra energy over the appliance's lifetime. Large, side-by-side refrigerator/freezers can carry an energy penalty because they have more surface area proportional to interior space. Through-the-door ice dispensers can increase energy use by 5 to 10 percent. Automatic defrost refrigerators, which use an internal heater to melt ice from the coils, can draw more than 600 watts for a short period during the defrost cycle, costing you about 12 percent more in overall energy use. The bottom line for energy efficiency: Avoid all extra features and penetrations, such as snack doors, and ice and water dispensers, if you can.

Remember the story you were told in grade school about how every time you opened the refrigerator door, the cold

**Ultra-high-efficiency refrigerators, like the Sun Frost, can be a good choice for off-grid applications.**



**The GE Monogram refrigerator will hold enough food for a big crowd.**

air rolled down and was replaced by warm air, making the refrigerator use more energy? This is only partly true. The cold air does drop—you can feel it on your feet—but air has a low mass, so the interior air is quickly recharged. Think about this as you compare the 24/7 energy penalty of an extra door penetration versus the energy cost of just opening the door when you need ice or a snack.

The most efficient configuration is a basic box shape with a solid exterior and manual defrost. Energy use will be about the same whether the refrigerator has a top or bottom freezer, *but* there will be more usable freezer space in a chest freezer or bottom freezer (if it is configured as a drawer) than in the freezer compartment of a standard upright refrigerator.

I can't repeat this often enough—refrigerators on the Energy Star list are there because they use at least 15 percent less energy than similar models, even with inherently inefficient designs. Find the most efficient model for the size, and leave out the watt-costly bells and whistles.

### Needs

Look in your refrigerator. How much of the space is occupied by condiments that only get used once in a great while? How many of the jars actually say "refrigerate after opening"? In many condiments, salt, sugar, and vinegar—agents that already act as preservatives—are the primary ingredients.

Food safety is important, but if something does not need to be stored in a cold space, or you almost never use it, you might consider reserving your valuable refrigerator space for higher priority occupants.

### Preshopping

Do some preshopping by visiting the Energy Star Web site (see Access). There, you can download the latest list of

## Refrigerator Comparison

Common Models	Suggested Retail (US\$)	Configuration	Defrost	Total Volume (c.f.)	Fridge Volume (c.f.)	Freezer Volume (c.f.)	Adjusted Volume* (c.f.)
Sanyo SR-1030	\$395	Top freezer	Auto	10.31	7.95	2.36	11.80
Whirlpool ET5WSEXKQ	479	Top freezer	Auto	14.50	10.70	3.80	16.89
Frigidaire FRT15HB3DW	379	Top freezer	Auto	14.75	11.01	3.74	17.11
Kenmore 74982	820	Top freezer	Auto	18.80	13.80	5.00	21.95
Kenmore 74282	920	Top freezer	Auto	21.60	15.10	6.50	25.70
GE Profile PTS25LHRWW	1,349	Top freezer	Auto	24.59	17.51	7.08	29.05
GE Monogram ZIS480	5,399	Side-by-side	Auto	30.61	17.77	12.84	38.70

### High-Efficiency Models

SunDanzer DCR225	\$1,049	Chest fridge	Manual	8.10	8.10	0.00	8.10
SunDanzer DCF165	949	Chest freezer	Manual	5.80	0.00	5.80	9.45
Sun Frost RF12	1,979	Top freezer	Partial	10.12	8.07	2.05	11.41
Sun Frost RF16	2,655	Top freezer	Partial	14.31	10.40	3.91	16.77
Sun Frost R10	1,595	Fridge only	Partial	9.13	9.13	0.00	9.13

Assumptions: On-Grid KWH costs = US \$0.10  
Off-Grid KWH costs = US \$0.75

Fresh food compartment = 38°F  
Freezer compartment = 5°F

Ambient = 90°F  
Life expectancy = 15 years

Energy Star refrigerators or use their search feature to find only the size and configuration you're considering.

Next, go to your favorite appliance store, whether it's on the Internet, in a "big box," or your local sales-and-service appliance center. Find out what brands they carry. Many refrigerator models appear across the brand spectrum. Sometimes all that is different is the brand name or shelf configuration. Compare the models you've selected on the Energy Star list.

### Testing, Location & Use

The National Appliance Energy Conservation Act dictates minimum standards for the energy consumption of refrigerators and freezers. Standards vary depending on the refrigerator's size and configuration. On January 1, 2004, the Energy Star criteria for refrigerators changed to require all full-size models to be at least 15 percent more energy efficient than the minimum federal standard.

U.S.-made refrigerators are tested at an ambient temperature of 90°F (32°C) in an attempt to approximate real-time energy use at room temperature with regular door

openings. The temperature in the fresh food compartment is set at 38°F (3°C), and the freezer is set at 5°F (-15°C).

The amount of energy used directly relates to the ambient temperature in the area where the refrigerator is kept. The penalty for each 10°F (5.5°C) increase in ambient temperature can increase energy use by as much as 70 percent! Keeping your refrigerator and freezer in a cool location can really save energy. But there is a caveat: To comply with warranty restrictions, most refrigerators must be kept in areas with temperatures above 45°F (7°C).

It is important to realize that stand-alone chest freezers are tested at a temperature setting of 0°F (-18°C). So if you are comparing a fridge/chest freezer combo with a top-freezer refrigerator (for example), you need to know that the chest-freezer combo may use a little more energy because it is also keeping your food at a colder temperature for the long term.

### Making Your Choice

To make your shopping easier, the comparison table shows a selection of today's most energy-efficient

Annual KWH	Annual KWH per Adjusted Volume	Annual Cost per Adjusted Volume	
		On-Grid	Off-Grid
350.0	29.67	\$5.20	\$24.48
372.0	22.02	4.09	18.40
376.0	21.98	3.68	17.96
392.0	17.86	4.28	15.88
422.0	16.42	4.03	14.70
475.0	16.35	4.73	15.36
592.0	15.30	10.83	20.77

78.9	9.74	—	\$15.94
133.6	14.13	—	17.29
171.0	14.98	\$13.06	22.80
254.0	15.14	12.07	21.91
101.0	11.06	12.75	19.94

\*The “adjusted volume” is a formula used to try to equalize energy consumption when comparing units with different refrigerator-to-freezer proportions.

refrigerators in their respective size categories. In terms of efficiency, many people think smaller is better. But in the 10-cubic-foot (0.28 m<sup>3</sup>) range, Sanyo’s SR-1030 (and at least two other identically sized brands) uses almost as much energy as models that are 40 percent larger, and more than twice as much energy as the similarly sized Sun Frost RF12.

Three models are listed in the 14- to 15-cubic-foot (0.4 m<sup>3</sup>) range. These are modest-sized refrigerators, less efficient per cubic foot than the larger ones, but more economical overall to purchase and run than any other size on the list. The Sun Frost RF16 reigns as the energy queen here, using 70 percent as much energy as the others and exceeding current standards by 36 percent. But if you are on-grid, the low up-front cost and easy availability of the Whirlpool ET5WSEXKQ makes it attractive. Of all the models listed, the Frigidaire FRT15HB3DW is the winner in terms of low cost to own and operate, but it is a special-order purchase.

In 18- to 19-cubic-foot (0.5 m<sup>3</sup>) and 21- to 22-cubic-foot (0.6 m<sup>3</sup>) sizes, Kenmore models shine, exceeding even current Energy Star ratings. They have a host of

models similar to the #74982 and #74282, all with the same energy usage profile, but with different configurations and features.

If you want a bigger-than-big fridge, General Electric’s 24.59-cubic-foot (0.7 m<sup>3</sup>) Profile PTS25LHRWW is the largest top-freezer refrigerator on the Energy Star list, and its performance exceeds that of same-sized Energy Star side-by-sides by as much as 20 percent.

Need bigger than that? GE claims that its 30.61-cubic-foot (0.87 m<sup>3</sup>) Monogram ZIS480, built-in, side-by-side is the most efficient model per cubic foot of space. It is also quieter than anything they’ve made to date.

Many more models shine when it comes to the features you might be looking for. The costs in the table are estimates to allow you to make reasonable comparisons. Use them as your yardstick, and make sure that anything you buy measures up when it comes to the trade-off between up-front cost, features you can live with for a long time, and energy performance.

It’s up to you to lay out your personal long-term strategy, which may include learning to use your expensive refrigerator space more effectively. Our behavioral choices, as well as our purchases, affect our bottom-line costs in refrigeration, as in everything else!

General Electric’s huge, top-freezer model—the Profile.



## Off-Grid? Consider a DC Fridge

Alternating current (AC) Energy Star units represent a pretty impressive energy savings. But if you are off-grid and on a tight energy budget, is “impressive” enough? Refrigerators range from conventional to Energy Star to ultra-high efficiency. The ultra-high-efficiency units cost more, but they can save energy in terms of kilowatt-hours.

Just how much should you spend to save a kilowatt-hour of energy? I live off-grid and have a direct current (DC) refrigerator and freezer—two separate units in different locations. Why would I want to spend the bucks for more than a basic consumer-level fridge and keep my freezer out in the shed?

### Conserve First

Energy production costs more than energy conservation. Where I live, with five average sun hours per day, producing an extra kilowatt-hour a day from a solar-electric system with generator backup would cost about US\$5,000 up front. I would need to expand our solar-electric array and battery bank, and provide extra generator run-time during the 15-year life of an average fridge (assuming I already have a generator and my inverter is big enough to handle the increased load). So buying the most efficient refrigerator and freezer I can find pays off immediately by avoiding that expense and hassle.

In addition, using a DC fridge and freezer means avoiding inverter efficiency loss, which averages

15 percent, depending on the inverter model and total load. It also means I can add more discretionary loads to my house without maxing out the inverter’s capacity. As a side benefit, if our inverter ever needs servicing, I won’t have to turn off food-storage cooling.

Because I wouldn’t need to run a generator as often in winter, I’d stave off the day when it would need servicing or replacing, and save on fuel. Another point of interest is that large loads withdraw energy from a battery faster, making less total energy available before the battery is fully discharged. It is worth noting that the larger and less efficient a refrigerator’s compressor is, the more it will tax your batteries.

I bought a Sun Frost R10, 10-cubic-foot (0.28 m<sup>3</sup>) refrigerator and a SunDanzer DCF225 8.1-cubic-foot (0.23 m<sup>3</sup>) chest freezer, both of which run directly off our 24-volt DC system. For those who want to store their food for the fewest watt-hours, SunDanzer makes ultra-high-efficiency chest refrigerators.

DC units have a few potential drawbacks. They may cost more initially, but can make up for their initial cost rapidly if you live off-grid. Your local appliance repairperson might (but won’t necessarily) sniff at the idea of servicing them. You will have to do without some features, notably the auto-defrost freezers found in almost all standard refrigerators today. And they only come in a few sizes (excluding the huge and enormous).

### Access

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U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy (EERE), Appliance and Commercial Equipment Standards • www.eere.energy.gov/buildings/appliance\_standards • Energy efficiency standards for residential and commercial products

“Chilling the Watt-Hours on a Mass-Market Fridge,” by John Bertrand, in *HP95*

### Refrigerator Manufacturers:

- Frigidaire • www.fridgidaire.com
- General Electric • geappliances.com
- Kenmore • www.sears.com
- Sanyo • www.sanyo.com
- SunDanzer • www.sundanzer.com
- Sun Frost • www.sunfrost.com
- Whirlpool • www.whirlpool.com

