Table 10-2: Electrical Consumption of Typical Appliances

Appliance	Annual usage (kWh)	Annual cost
Ten-year-old refrigerator or freezer	1250	$188
New ENERGY STAR refrigerator or freezer	500	$75
Television	100–1000	$15–$150
Clothes dryer	1200	$180
Well pump	500	$75
Furnace fan	500	$75
Computer	50–400	$8–$60
Hot tub, spa	2300	$345
Water bed	1000	$150

Data from Lawrence Berkeley Laboratory and others. Based on 15¢ per kilowatt-hour for electricity.

10.1 Refrigerator Replacement and Maintenance

Refrigerators built after 1993 use less electricity than refrigerators built before that year. Another efficiency increase occurred in 1999 in the refrigerator industry.

10.1.1 Refrigerator Replacement

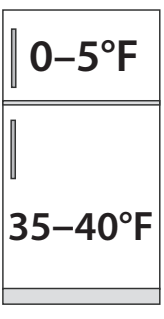
SWS Detail: 7.0101.1 Refrigerator and Freezer Replacement

Comply with the following requirements when replacing refrigerators.

✓ The new refrigerator must fit the existing space.

- ✓ The new refrigerator must be 40% more efficient than the minimum federal standards or be labeled ENERGY STAR.
- ✓ The new refrigerator must have a minimum one-year warranty.
- ✓ Take refrigerators that are replaced to a facility that is licensed to reclaim their refrigerant and recycle the refrigerator's parts.
- ✓ No refrigerator, taken out of service, may be returned to service by sale, barter, or for free.
- ✓ Instruct the client about location and operation of energy controls such as the thermostats for the refrigerator and freezer.

Some clients use two or more refrigerators in their homes, and this practice results in high electricity usage. Suggest to these clients to consolidate food storage into a large single refrigerator.



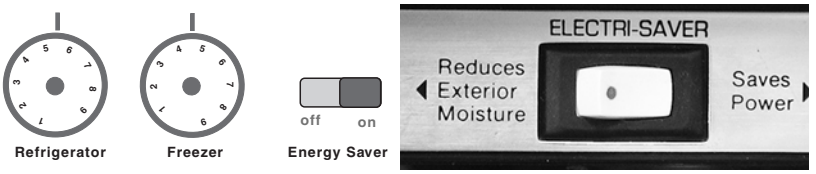
Refrigerator clean and tune: Clean coils and check temperatures. Adjust temperatures that are out of range.

10.1.2 Refrigerator Cleaning and Tuning

SWS Detail: 7.0101.2 Refrigerator/Freezer Clean and Tune

Cleaning and tuning an existing refrigerator can increase its efficiency. Follow these procedures.

- ✓ Clean dirt off clogged coils.
- ✓ Move objects that block airflow around the refrigerator, and ask the client to store the objects elsewhere.
- ✓ Measure refrigerator temperature and verify that it is between 35° and 40° F. Otherwise re-set the thermostat to this temperature range.
- ✓ Measure the freezer temperature, and verify that it is more than or equal to 0° F. If it is colder that 0°, re-set the freezer's thermostat to 0° F.
- ✓ Check the condensation-control switch. If the condensation control is on, the refrigerator door or door frame is being heated. Try turning the switch to "energy saver" which turns the heating elements off. If frost forms on the door, turn the control back on.
- ✓ Explain the function of the condensation control to clients. If the energy-saver setting isn't adequate for very humid weather, the occupants could toggle setting.



Refrigerator energy controls: Refrigerator and freezer temperatures aren't typically labeled in degrees, so there might be some trial and error in getting the setting within range. The condensation control is either on and heating the door perimeter or off and not heating the door perimeter.

10.1.3 Refrigerator Metering Protocol

Older refrigerators use from 1000 to 2000 kWh per year. Newer ENERGY STAR refrigerators use less than 400 kWh per year. You need a minimum of two hours to accurately measure refrigerator energy consumption using a recording watt-hour meter.

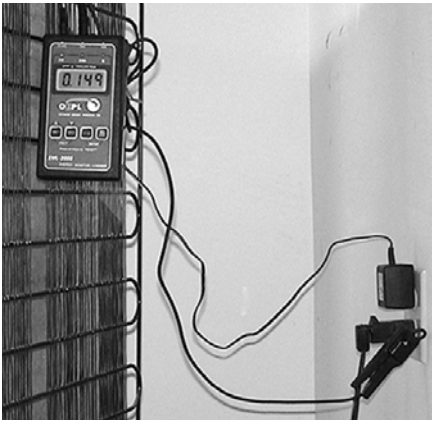
There are two (2) common options for evaluating refrigerator energy consumption for replacement.

1. The first option is to follow the metering procedure presented here.
2. If metering isn't practical, use the database housed in the Weatherization Assistant (WA) Software.

Metering Accuracy Issues

A number of unusual circumstances could reduce the accuracy of the metering, including the following.

- A quantity of warm food recently placed in the refrigerator.
- Abnormally high or low ambient temperature. For example: refrigerators in garages during the summer or winter; or refrigerators in vacant homes where heating or cooling systems aren't operating.

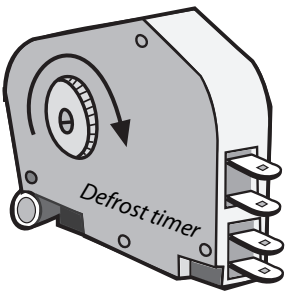


Recording watt-hour meter: Measures energy consumption over time. The better units can also calculate monthly consumption, or record maximum current draw to help identify the defrost cycle.

Refrigerator Metering Procedure

If the refrigerator is an automatic-defrost model, you could measure an inaccurate reading if the unit goes into the electric defrost mode during the test period. The following test protocol includes provisions to prevent the defrost mode from activating.

1. Determine if the refrigerator is equipped with automatic defrost. This is usually stated on the manufacturer's data plate or on the outside of the unit. If the refrigerator is equipped with a manual defrost, proceed to step 3.
2. If the unit is equipped with automatic defrost, follow this sub-procedure.
   a. Locate the defrost timer. This small electrical-control box is located in the refrigerator or behind the front kick-plate. The defrost timer may also be located on the rear of the unit.

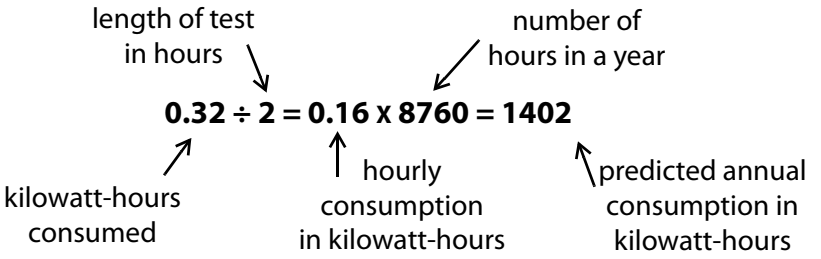


Defrost Timer: The defrost timer initiates the defrost cycle to melt ice at regular intervals.

   b. Open the defrost timer and locate the advance pinion. This shaft usually has a screwdriver slot to allow you to manually advance the timer.
   c. Turn the timer clockwise (you can break the timer if you turn it counter-clockwise) until you hear a loud click. This turns the defrost heaters on. Turn it further until it clicks loudly again, turning the defrost heaters off.
   d. You can now perform your measurement since the timer won't call for defrost heat again for several hours.
3. Connect the refrigerator to a recording watt-hour meter. Run the test for at least two hours. You don't need to stop at two hours, and a longer measurement is better. During the test, avoid opening the refrigerator, or do so briefly.

4. At the end of the test, read the kilowatt/hours of consumption measured by the meter. Divide this number by the number of hours in the test. This gives you the number of kilowatt-hours consumed each hour. Multiply this number times the total number of hours in a year (8760 hours per year). The product of this calculation is the annual kilowatt-hours of electrical usage.

5. **Remove the meter and plug the refrigerator back into its outlet.**



Refrigerator consumption example: In this example, a 2-hour measurement was performed. During this time, the appliance consumed 0.32 kilowatt-hours of electricity, or 0.16 kilowatt-hours per hour. The annual total of 1402 kilowatt-hours, calculated above, is well beyond the 450 kilowatt-hours per year consumed by today's most efficient refrigerators.

Table 10-3: Kilowatt-Hours per Hour & Kilowatt-Hours per Year

kWh/hour	kWh/year	kWh/hour	kWh/year
0.23	2000	0.16	1400
0.22	1900	0.15	1300
0.21	1800	0.14	1200
0.19	1700	0.13	1100
0.18	1600	0.11	1000
0.17	1500	0.10	900