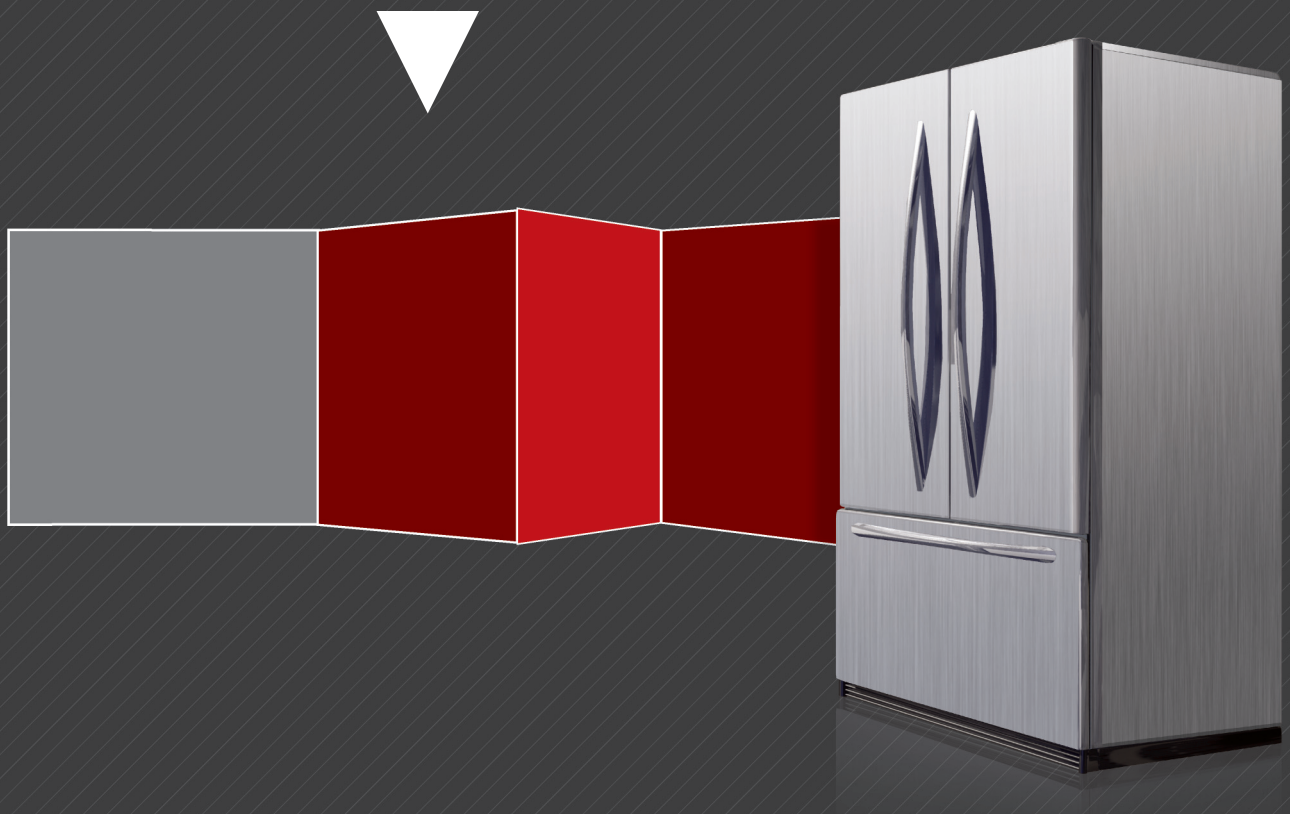
NEW OPPORTUNITIES MULTIPLY **SAVINGS**



Refrigerator Market Profile | 2009

U.S. Department of Energy

ENERGY STAR

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ABOUT THIS DOCUMENT

This document is intended to provide policy makers and energy efficiency program managers with a clear understanding of refrigerator energy consumption, the residential refrigerator market, and the installed base. This document also gives design guidance to help program sponsors develop more effective programs to reduce energy consumption for residential refrigeration.

EXECUTIVE SUMMARY

National and State appliance standards have dramatically improved the overall performance of refrigerators over the last two decades, cutting refrigerators' annual energy consumption in half.

- Nevertheless, efficiency program sponsors can capture substantial additional energy savings from programs that:
  - **Increase ENERGY STAR® market share.** Only three out of 10 refrigerators sold are ENERGY STAR qualified.
  - **Increase the rate at which discarded and displaced refrigerators are permanently retired.** Forty-four percent of refrigerators that could be retired stay on the grid instead. They are kept as second refrigerators, sold, or given away.
  - **Increase the rate at which pre-1993 refrigerators are removed from the grid.** Twenty-three million inefficient units manufactured before 1993 are still in use.
  - **Reduce the number of second refrigerators and/or their annual energy consumption.** Twenty-six percent of all U.S households have a second refrigerator. This number is growing at the rate of 1 percent per year.
- **Achieving significant refrigerator savings requires both promoting more efficient models and discouraging retention of older but working displaced refrigerators.** Three-quarters of refrigerators that are displaced or discarded still work; more than half of these working units stay in service.
- **Appliance retailers are well positioned to help Energy Efficiency Program Sponsors achieve these objectives:**
  - Retailers are the primary contact for the key target audience, households planning to buy a new refrigerator, and can interact with them at the time they are making decisions about disposal of their old unit.
  - Retailers can cost-effectively recover units being replaced and ensure that they are retired, because they usually deliver new units to homes and have efficiencies of scale for storing and recycling old units.
  - Retailers will be interested in collaborating on programs to promote early retirement of older refrigerators because they will benefit from increased unit sales.
- **Program sponsors interested in reducing the number of second refrigerators or encouraging limited use may need to work with other groups in addition to retailers, as it is not in retailers' financial interest to promote objectives that do not directly lead to new sales.**
- **Pick-up, retirement, and recycling of non-working refrigerators may be cost effective for program sponsors needing to meet aggressive carbon reduction goals.** Full recycling of refrigerators can increase carbon savings per unit up to 40 percent by capturing the potent greenhouse gases trapped in the foam.

MARKET SUMMARY

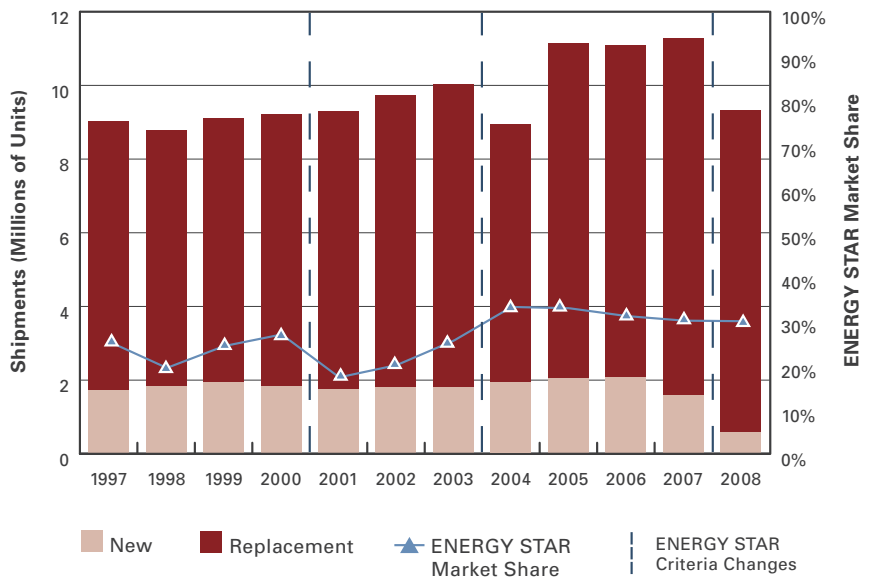
Unit Sales

National Sales

While the market for refrigerators is mature and relatively stable, it has been dramatically affected by the recession. Refrigerator sales declined 18 percent in 2008, although they are expected to recover when the recession ends. Annual sales range from 8 million to 12 million units.

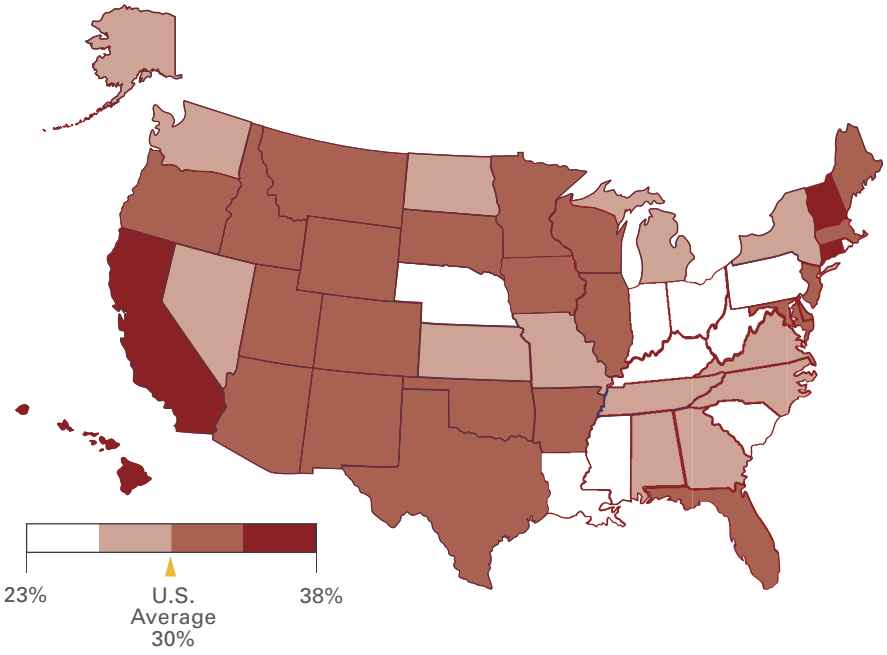
ENERGY STAR qualified units have accounted for about 30 percent of all unit sales since 2004, despite the introduction of more stringent criteria last year. The stability of ENERGY STAR market share may be due in part to the fact that manufacturers and retailers have promoted energy efficiency as a product feature to increase sales of more expensive products with higher profit margins.

U.S. Refrigerator Sales and ENERGY STAR Market Share



Sources: Sales from "Annual Portrait of the U.S. Appliance Industry," *Appliance Magazine,* 1998 to 2009. New units derived from U.S. Census Bureau, "2008 Characteristics of New Housing," June 2009.

ENERGY STAR Market Share by State

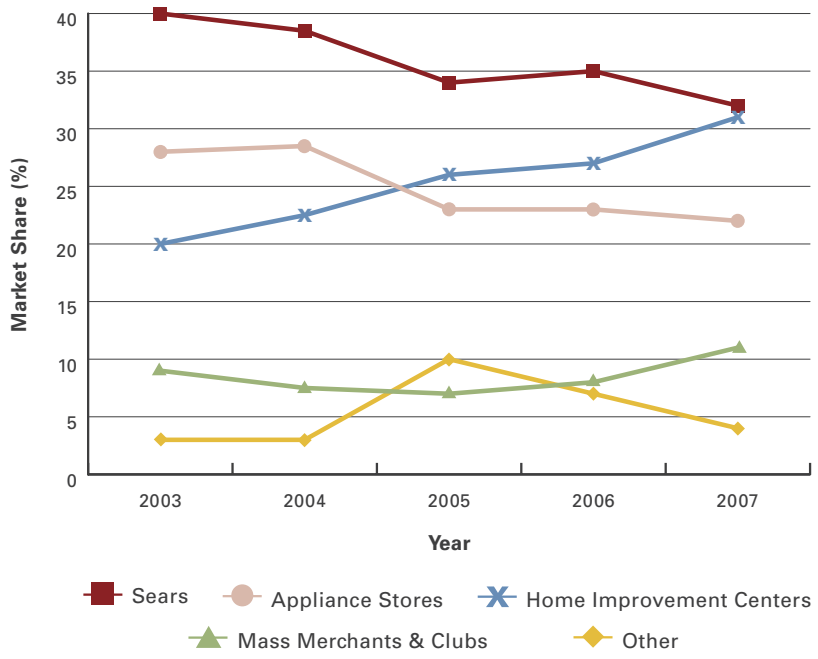


Source: 2007 ENERGY STAR Qualified Appliance Retail Sales Data, www.energystar.gov/ia/partners/manuf_res/2007FinalSalesData.xls.

Regional Sales

Market share for ENERGY STAR qualified appliances is generally higher than average in States and regions with longstanding or very active energy efficiency programs (e.g., California and Vermont) and those with particularly high electricity prices (e.g., Hawaii, Connecticut, and New Hampshire). These states had the highest market shares in 2007, between 35 and 38 percent.

Refrigerator Market Share by Retail Sales Channels



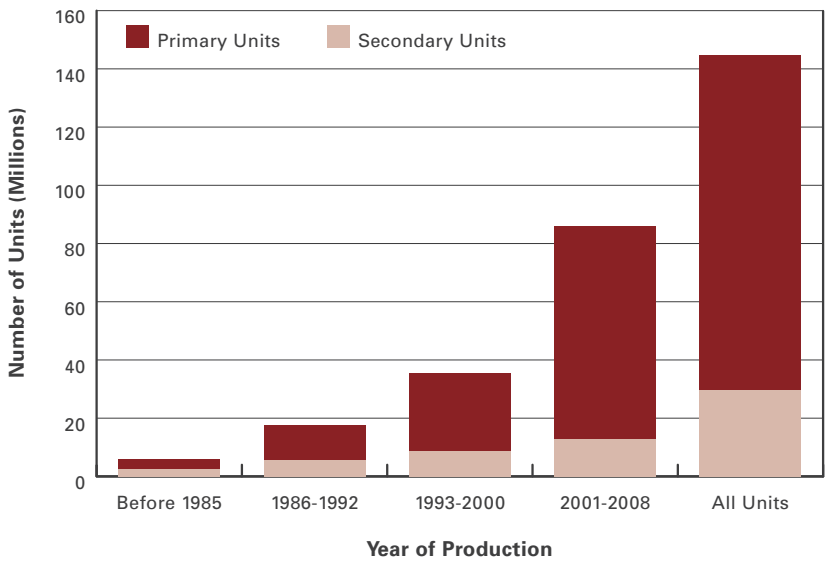
Source: "State of the Industry" reports, Home Furnishing News, 2003-2008.

Retail Sales Channels

Refrigerators are sold primarily through Sears, home improvement centers such as The Home Depot and Lowe's, mass merchants such as Costco and Sam's Club, and independent appliance retailers. The share of sales flowing through each of these channels has shifted over the last five years, with Sears and independent appliance dealers losing market share to home improvement retailers and mass merchants. In 2007, Sears and the home improvement sector each accounted for 33 percent of sales, independent retailers for 22 percent, and mass merchants for 11 percent. Four percent of sales went through other channels.

Independent appliance stores have been able to minimize their market share losses through membership in national buying groups. These umbrella organizations, notably Nationwide Marketing Group, AVB Brand Source, and the NATM Buying Corporation, serve as points of contact for promotional campaigns and enable independent retailers to pool their purchasing power.

Distribution of Refrigerators by Year of Production in the Installed Base



Note: The total number of units is 9 percent higher than total shipment numbers from *Appliance Magazine* due to differences in the methodology for calculating shipments.

Sources: D&R International estimate based on analysis from "Residential Energy Consumption Survey 2005," U.S. Energy Information Administration, and "Annual Portrait of the U.S. Appliance Industry," *Appliance Magazine,* 1998 to 2009.

Installed Base

Current Installed Base

As of 2008, 145 million standard-sized refrigerators (7.5 or more cubic feet) were installed in U.S. homes. Virtually every home (99 percent) in the United States has one or more refrigerators[1] and 26 percent has two or more. While the average working life of a refrigerator is 12 years,[2] 24 percent of the installed base (35.3 million units) is between 10 and 15 years old, 16 percent of the base (23.5 million units) is over 15 years old.

Trends in the Installed Base

There have been three major trends in refrigerator sales over the last 30 years that affect the efficiency of the installed base: increasingly stringent Federal efficiency standards, changing preferences in size and configuration, and increasing use of second refrigerators. Each of these trends is discussed in more detail below.

Increasing Efficiency

Before Federal energy efficiency standards for refrigerators were established in 1990, units could be very energy intensive. Due to the 1990 standards, revisions in 1993 and 2001, and ENERGY STAR criteria in 1997, 2001, 2004, and 2008, refrigerator energy consumption has fallen dramatically, even as the sales-weighted average size of units sold has increased from about 20 to 22 cubic feet.

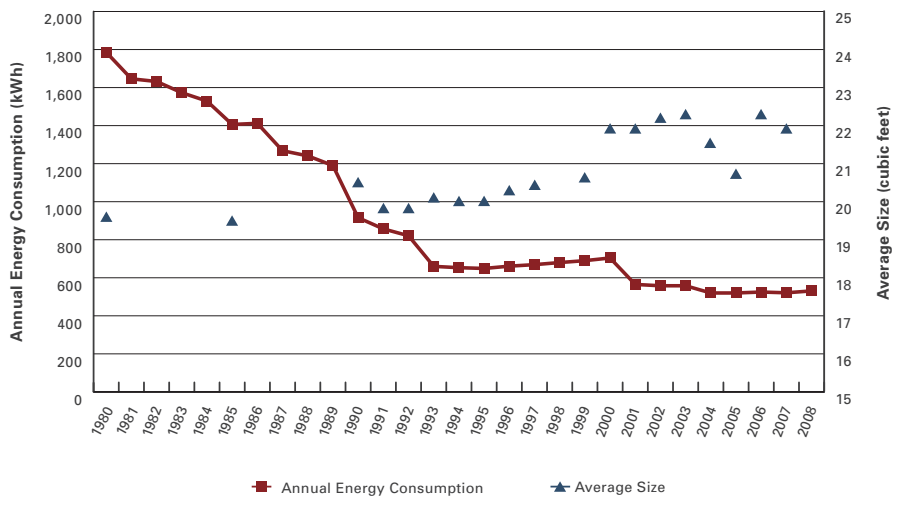
1993 – THE GREAT EFFICIENCY DIVIDE

Because significant reductions in annual energy consumption occurred after Federal standards were set in 1990 and then revised in 1993, "post-1993" and "pre-1993" are used to distinguish between efficient and inefficient units in the installed base. "Post-1993" includes models sold in 1993.

Units manufactured today consume about one-third as much electricity as those manufactured 30 years ago and about half as much as the typical unit manufactured before 1993.

The relative energy efficiency of a refrigerator is a function of several factors, including configuration, compressor design, quantity of insulation, quality of the door seal, and size. The configuration, *i.e.,* the relative positions of the refrigerator and freezer compartments and the presence or absence of through-the-door water and/or ice dispensers, has the greatest influence on annual energy consumption. A top freezer model without through-the-door ice service uses 20 percent less energy than a bottom- or side-mounted freezer of the same size.[3]

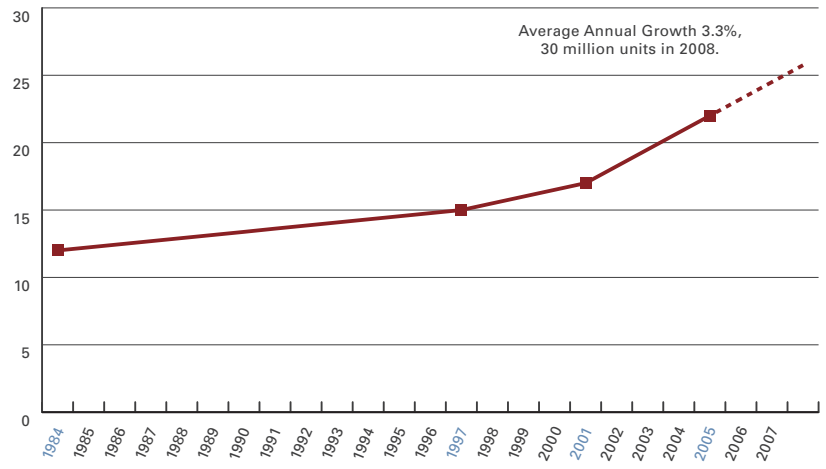
Shipment-Weighted Average Refrigerator Annual Energy Consumption and Size, 1980 to 2008



All values are based on sales-weighted averages. Average energy consumption per unit includes ENERGY STAR qualified models. Average size is provided for the years data was available. Energy consumption does not include degradation.

Source: Association of Home Appliance Manufacturers, *Fact Book,* 2009.

Percent of Homes with Second Refrigerators



Source: "Residential Energy Consumption Survey 1984, 1997, 2001, 2005," U.S. Energy Information Administration.

Configuration, Size, and Consumption

The mix of configurations available has changed significantly in the last five years. Declining profit margins have led to a decrease in traditional top freezers, while greater demand has led to an increase in bottom freezers. Most models shipped in 2008 were top or bottom freezers without through-the-door water and ice service and side-by-side models with this service.

The average size of units increased by 10 percent between 1990 and 2000. However, average and median unit sizes have remained relatively stable since 2000 because the average home doesn't have space for a larger unit.

Comparison of Models, Volume, and Consumption, 2003 and 2008

Type of Refrigerator	Models Offered (%)		Median Unit Volume (cubic feet)		Median Annual Electricity Consumption (kWh/year)		2008 Maximum Annual Energy Consumption (kWh/year)	
	2003	2008	2003	2008	2003	2008	Federal Standard	ENERGY STAR
Top Freezer	55	38	18	18	478	454	477	382
Top Freezer-Ice	3	0	18	–	482	–	–	–
Bottom Freezer	5	16	20	21	522	482	573	458
Bottom Freezer-Ice	0	2	–	25	–	554	689	551
Side by Side	5	4	24	25	640	580	661	529
Side by Side-Ice	32	40	25	25	668	607	722	578

Note: Median annual electricity consumption includes ENERGY STAR qualified models. 2008 Maximum Annual Energy Consumption values based on models that include automatic defrost, using median unit size for each configuration. Annual electricity use is calculated based on Adjusted Volume = (Fresh Volume) + 1.63 x (Freezer Volume). Energy consumption of an ENERGY STAR qualified model is calculated as 20 percent more efficient than a non-qualified model of the same size and configuration.

Sources: Models and Median Unit Volume from Federal Trade Commission, U.S. Department of Commerce, 2009. Federal standards from *National Appliance Energy Conservation Act, Code of Federal Regulations 10CFR430.32*. ENERGY STAR criteria from www.energystar.gov.

Growing Prevalence of Second Refrigerators

The use of second refrigerators has grown steadily in the past two decades. Every year, approximately 10 percent of households purchasing new refrigerators keep their old units, increasing the base of second units by 800,000 to 1 million units annually.[4] In 1984, just 12 percent of U.S. households had a second refrigerator; by 2005, this number had risen to 22 percent.[5] These values vary among regions. Direct on-site inventory studies in California and the Northwest have found second refrigerators in 19 and 34 percent of homes, respectively.[6]

Most second units are displaced primary units and a large proportion of them are pre-1993 models (28 percent vs. 16 percent for primary).

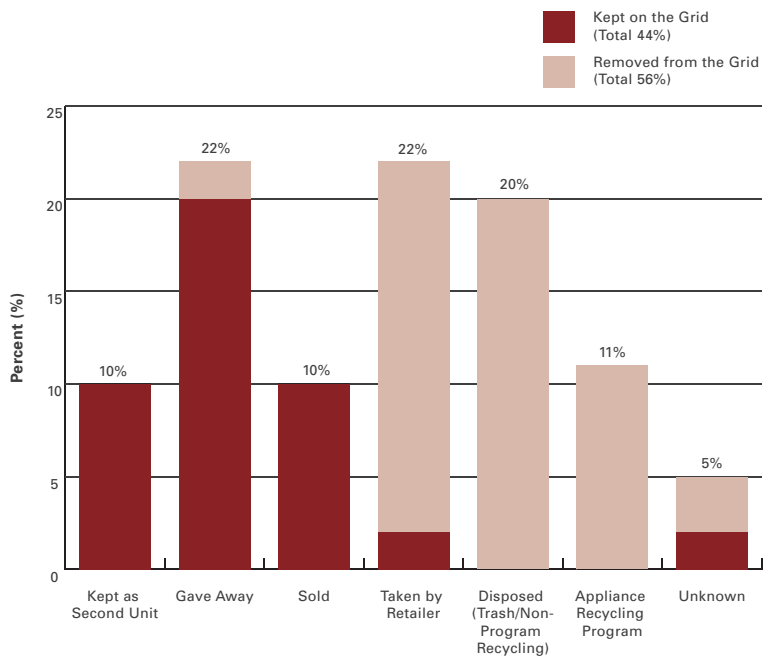
Larger, suburban, and higher-income households are much more likely to own a second refrigerator.

- Twenty-eight percent of larger rural and suburban households have a second refrigerator, while only 18 percent of homes in towns and cities do.
- Forty-one percent of households with incomes over $80,000 a year are also more likely to own a second refrigerator, compared to 17 percent of all other households.[7]

Refrigerator Disposal and Displacement

Ten percent of households buying new refrigerators will keep their old primary units as second units. Of those that don't, a study in California found that the old units will be taken by the retailer (25 percent), sold (10 percent), given away (22 percent), recycled (17 percent), or thrown away (13 percent). Just over half are permanently retired, but the remainder (44 percent) stay in service and continue to contribute to the total electric load.[8] The proportion of units given away is reported to have declined since the study was completed because many charities are refusing to accept older refrigerators.

Fate of Old Units Based on Studies in California and Vermont



	Kept as Second Unit	Gave Away	Sold	Taken by Retailer	Disposed (Trash/Non-Program Recycling)	Appliance Recycling Program	Unknown
Percent Working at Time of Action	100%	93%	96%	64%	56%	100%	–

Sources: ADM Associates et al., "Evaluation Study of the 2004-05 Statewide Residential Appliance Recycling Program," submitted to the California Public Utilities Commission, April 2008; "Final Report: Phase 2 Evaluation of the Efficiency Vermont Residential Programs," Vermont Department of Public Service, December 2005; "Verify and Measure Savings of Refrigerator Recycling Programs," Sacramento Municipal Utility District, August 2007.

Distribution of Pre- and Post-1993 Refrigerators

Primary Unit Model Year	Second Unit Model Year	Percentage of U.S. Households	Average Energy Consumption (kWh)
Post-1993	No Second Unit	62.4	573
Pre-1993	No Second Unit	9.9	1,080
Post-1993	Post-1993	14.0	1,146
Post-1993	Pre-1993	4.8	1,653
Pre-1993	Pre-1993	1.1	2,160
Pre-1993	Post-1993	1.4	1,653
Unknown	–	6.4	–

Sources: Percentage of U.S. households from "Residential Energy Consumption Survey 2005," U.S. Energy Information Administration. Average energy consumption calculated using data obtained from the Association of Home Appliance Manufacturers in 2009.

ENERGY SAVINGS

Savings Potential

Despite dramatically improved efficiencies and the availability of ENERGY STAR qualified units, the energy-savings potential from reducing refrigerator electric load remains high. If every non-qualified refrigerator in the United States were retired and replaced with a 2008 ENERGY STAR qualified unit, national savings by 2030 would be 38 TWh per year.[9]

Potential energy savings for refrigerator retirement/recycling programs are substantial, generally about 20 to 30 percent of the savings obtainable from lighting programs, and can exceed savings from other popular efficiency measures, including replacing old HVAC systems.

Energy-Savings Potential for Refrigerator Retirement Compared to Other Common Energy Efficiency Measures

	Silicon Valley Power[1]	New Hampshire[2]	Central Electric Power Cooperative, South Carolina[3]	National Energy Efficiency Potential[4]
Annual Savings (MWh)				
Refrigerators and Freezers	6,500	97,440	84,723	38,000,000
Lighting	47,000	243,332	480,696	169,000,000
HVAC	–	26,697	72,554	117,000,000
Program Information				
Population	42,000	1,350,000	700,000	363,584,435
Year of Savings Potential	2016	2018	2017	2030
Potential Type	Cost-effective	Attainable	Cost-effective	Cost-effective

Sources: 1. "Demand Response and Energy Efficiency for Silicon Valley Power," Rocky Mountain Institute, May 2007. 2. "Additional Opportunities for Energy Efficiency in New Hampshire," New Hampshire Public Utilities Commission, January 2009. 3. "Electric Energy Efficiency Potential Study for Central Electric Power Cooperative, Inc.," GDS Associates, September 2007. 4. Brown et al., "U.S. Building-Sector Energy Efficiency Potential," Lawrence Berkeley National Laboratory, September 2008.

Key Savings Opportunities for Program Sponsors

Based on the current market and inventory of refrigerators, the U.S. Department of Energy (DOE) has identified these savings opportunities for program sponsors.

Energy Savings Opportunities for Program Sponsors

Opportunity	Annual Savings			
	Per Unit		Aggregate U.S. Potential	
	kWh	$	MWh	$ million
1. Increase the number of buyers that purchase ENERGY STAR qualified refrigerators. • 9.3 million units were sold in 2008. • 70 percent were not ENERGY STAR. • 6.5 million potential units per year could be upgraded.	105	82	2,812,000	78
2. Decrease the number of units kept on the grid when new units are purchased. • 8.7 million primary units were replaced in 2008. • 44 percent remained in use, whether they were converted to second units, sold, or given away. • 3.8 million units are candidates for retirement every year.	740	82	2,812,000	311
3. Decrease the number of second units. • 26 percent of households had a second refrigerator in 2008. • 29.6 million units are candidates for retirement.	840	93	28,864,000	2,757
4. Replace pre-1993 units with new ENERGY STAR qualified models. • 16 percent of all units in use in 2008 were manufactured before 1993. • 23.4 million total potential units are candidates for targeted replacement.	577	64	13,507,000	1,451

Sources: See endnote 10.

Energy and Cost Comparison for Upgrading to ENERGY STAR

Purchase Decision	New Non-ENERGY STAR Qualified Refrigerator	New ENERGY STAR Qualified Refrigerator
Annual Consumption	540 kWh	435 kWh
	$60	$48
Annual Savings	–	105 kWh
	–	$12
Average Lifetime	12 years	12 years
Lifetime Savings	–	1,260 kWh
	–	$140
Price Premium	–	$30 - $100
Simple Payback Period	–	3-8 years

Note: Calculations based on shipment-weighted average annual energy consumption of 2008 models. An ENERGY STAR qualified model is at least 20 percent more efficient than a new non-qualified refrigerator of the same size and configuration.

Source: See endnote 10.

Energy and Cost Comparison for Removing a Second Refrigerator from the Grid

Fate of Retired Primary Unit	Post-1993 Unit		Pre-1993 Unit	
	Remains on the Grid	Removed from the Grid	Remains on the Grid	Removed from the Grid
Annual Consumption	627 kWh	0	1,012 kWh	0
	$70	0	$112	0
Annual Savings	–	627 kWh	–	1,012 kWh
	–	$70	–	$112
Average Lifetime*	6	–	6	–
Lifetime Savings*	–	3,762 kWh	–	6,072 kWh
	–	$417	–	$672
Removal Cost	–	$50 - $100	–	$50 - $100
Simple Payback Period	–	1-2 years	–	<1 year

*Assumes unit has six years of functionality remaining.

Sources: See endnote 10.

Energy and Cost Comparison for Early Retirement and Replacement of Pre-1993 Refrigerators

Decision	Pre-1993 Unit				
	Left in Place	Replaced with New ENERGY STAR Qualified Unit			
Annual Consumption	1,012 kWh	435 kWh			
	$112	$48			
Annual Savings	–	577 kWh			
	–	$64			
Average Lifetime of Savings*		1-4 years			
		1 Year	2 Years	3Years	4 Years
Incremental cost of purchasing now rather than waiting 1, 2, 3, or 4 years	$	35	70	103	135
Total savings from replacing old unit now rather than waiting 1, 2, 3 or 4 years	kWh	577	1,159	1,747	2,340
	$	64	127	188	248
Net savings from early replacement	$	29	57	85	113

*Assumes existing unit has 4 years of functionality remaining.

Incremental cost compares the difference between a purchase today (at a cost of $1,180) to a discounted purchase in the future, using a real discount rate of 3 percent. Total savings include an energy consumption degradation of 1.37% per year.

Sources: See endnote 10.

Net to Gross

Program sponsors have run a number of refrigerator recycling programs. Net-to-gross values can vary due to differences in program design and net-to-gross calculation methodologies. In the most recent programs, the net-to-gross has exceeded 0.60.

Refrigerator Recycling Net to Gross Values

Program (Year)	Net-to-Gross Value
Efficiency Vermont (2005)a	0.35
Sacramento Municipal Utility District (2007)b	0.61
California – Various Programs (1996-2004)c	0.53 (median)
California – Statewide (2004-2005)d	0.61
Connecticut Light and Power (2005)e	0.30
Wisconsin Focus on Energy (2003)f	0.43

Sources: See endnote 11.

PROGRAM DESIGN CONSIDERATIONS

As refrigerator efficiency standards improve and the savings potential between ENERGY STAR levels and the Federal efficiency standard decreases, the challenge for program sponsors is to find greater savings by influencing consumer purchasing decisions. Programs that focus on the benefits of removing, replacing, and/or retiring an older working refrigerator offer much greater savings potential, as the tables detailing the key savings demonstrate. To capture these savings opportunities program sponsors will need to identify and influence distinct groups of consumers.

1. **Planning to buy a new refrigerator and**
   - Do not have a working refrigerator or
   - Have a working refrigerator

2. **Not planning to buy a new refrigerator and**
   - Have a pre-1993 refrigerator and/or
   - Have a second refrigerator.

Targeting Refrigerator Programs

Situation		Influencing Factors

Planning to buy a new primary refrigerator	No working unit (old unit broken)
	▪ Must buy now
	▪ Want old unit removed
		▪ How the salesperson frames the choice
		▪ Product attributes
		  ○ Availability
		  ○ Price
		  ○ Installation cost
		  ○ Operating/lifetime cost
		  ○ Product features
		▪ The attractiveness of more efficient units
		  ○ Lower operating and lifetime cost
		  ○ Availability of incentives and/or rebates

	Have working unit ▪ Age of working unit (pre-/post-1993) ▪ Intend to keep, junk, give away, or sell the working unit	▪ Same as above, plus ▪ Compelling communication on the operating cost of the old refrigerator to whomever uses it next
Not planning to buy	Have pre-1993 primary unit ▪ Higher energy bills than average ▪ Older unit has fewer modern features	▪ Compelling communication that older unit is costing them money ▪ The attractiveness of more efficient units with lower energy costs ▪ Convenience in removing the old unit
	Have second unit ▪ Higher energy bills than average ▪ Possibly underused unit	▪ Compelling communication that second unit is costing them money ▪ Convenience in removing the old unit ▪ Options that reduce consumption (new unit, smaller unit, unplugging, retirement)

Does it make sense to promote early retirement of pre-1993 refrigerators?

As the adjacent table shows, customers pay an incremental cost by replacing a pre-1993 unit now, but the energy savings are much higher. The longer the replacement is delayed, the more savings are lost. Therefore, the best option is to replace an old unit as soon as possible.

Each of these categories of consumers will require distinct interventions and motivational strategies. In developing such strategies, program sponsors should consider the following factors:

Reaching households already planning to buy a new refrigerator

Program sponsors that wish to capture the greatest potential energy savings must persuade purchasers to both a) choose an ENERGY STAR qualified model and b) retire their old unit rather than give it away, sell it, or use it as a second unit. Program sponsors with carbon reduction goals can also capture the equivalent of an additional 5,000 lbs of carbon dioxide by fully recycling the returned unit, rather than just the refrigerants, as required by law. Partnering with retailers may be essential to cost-effectively capture these savings, but it requires thoughtful program design. The retail sales experience is the prime opportunity to influence a consumer's decision.

REFRIGERATOR PICK-UP: WHAT TO ASK OF A RETAILER

To ensure that old refrigerators do not reenter the market and to accurately track savings, programs in New Jersey, Vermont, California, Rhode Island, and Massachusetts[12] have recently begun to ask retailers to perform three tasks:

- Cut the cord to avoid resale of an inefficient unit.
- Record the model number, vintage, and size for program auditing.
- Ensure that the refrigerator is still working before counting the energy savings from removing an old unit from the grid.

Why Partner with Retailers?

- Retailers' goals of selling greater numbers of higher margin refrigerators, typically ENERGY STAR qualified models, align with the program sponsor's goals.
- Retailers can make retirement convenient and economical by removing the old unit when delivering the new one.
- Retailers can consolidate units for bulk pick-up by licensed recyclers.

Program Design Considerations

- Retailers have no direct economic motivation to promote retirement and recycling, so programs must be structured to create one.

Reaching households with a pre-1993 or second unit, not planning to buy a new unit.

Program sponsors that wish to capture the fullest portion of energy savings from residential refrigeration must persuade households to replace pre-1993 units with new units and retire or reduce the energy consumption of secondary refrigerators.

Partnering with Retailers

- Retailers will likely be eager to partner with program sponsors to persuade consumers to retire pre-1993 units because retailer goals align with those of program sponsors and retailers are already investing heavily in marketing to this population.
- If program sponsors wish to reduce the number of secondary refrigerators rather than reducing the energy consumption of these units, they will need to pursue this independent of the retailer. Retailers have no motivation to persuade a customer to give up a refrigerator unless it will result in a sale

ADDITIONAL PROGRAM RESOURCES

ENERGY STAR Make a Cool Change: Recycle Your Old Fridge (or Freezer) Campaign

ENERGY STAR has developed an appliance recycling campaign to support partners' recycling activities. For a list of current refrigerator and freezer recycling programs throughout the United States, sample recycling contract language, sample articles, and other tools, visit www.energystar.gov/recycle or contact appliancecampaign@energystar.gov.

ENERGY STAR Refrigerator Partner Resource Guide

The Refrigerator Partner Resource Guide contains messaging, savings numbers, and infographics that partners can use to promote ENERGY STAR qualified refrigerators. The guide includes information on advanced technologies, retirement, recycling, and best practices. Download the partner resource guide at www.energystar.gov/index.cfm?c=manuf_res.pt_appliances.

State Energy-Efficient Appliance Rebate Program

On July 14, 2009, DOE announced the availability of nearly $300 million in funding from the American Recovery and Reinvestment Act to encourage purchases of new ENERGY STAR qualified appliances. These funds will be made available to States and U.S. Territories to launch new consumer rebate programs for energy-efficient appliances, including refrigerators. For information on rebates, visit www.energystar.gov. (Note: Specific information for each state should be available following disbursement on November 30, 2009.)

Responsible Appliance Disposal (RAD) Program

The U.S. Environmental Protection Agency's Responsible Appliance Disposal (RAD) Program is a voluntary partnership to help protect the ozone layer and reduce greenhouse gas emissions. Find program details at www.epa.gov/ozone/partnerships/rad/index.html.

Summary of Results from *Chill Out London* Program

Customers	127,000
Refrigerators/Freezers Recycled	14,439 (single family 5,223) (multifamily 9,216)
Participation Rate	11.4%
Incentive	$75 (single family) $133 (average, 10+ unit apartments)
Cost of Energy Saved	Between $0.017 and $0.108 per kWh (Canadian$)

For more information on the Chill Out London program, visit www.chill-out.ca/terms.html.

CHILL OUT LONDON PROGRAM

In 2006, London Hydro in Ontario implemented its Chill Out London refrigerator, freezer, and air conditioner retirement program.

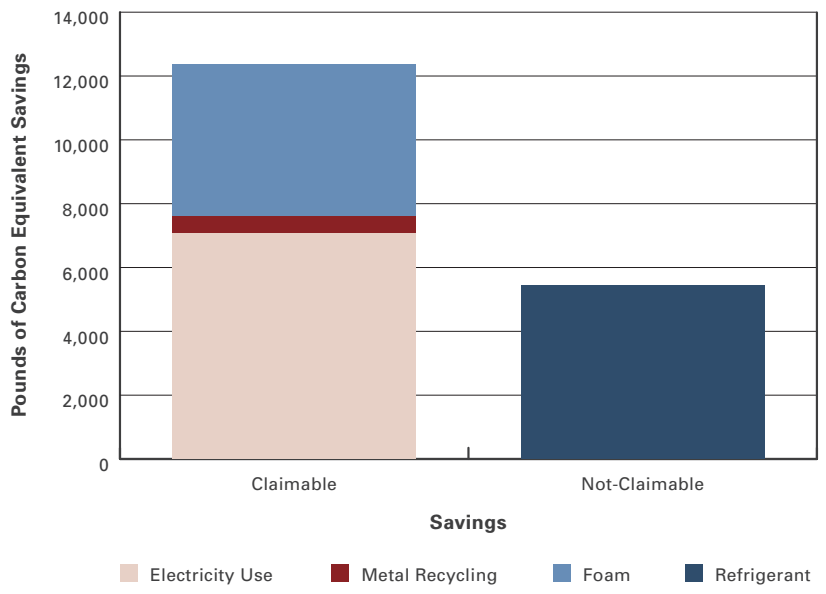
A unique feature of the program was the targeting of owners and managers of multi-unit master-metered buildings. Because of the inherent efficiencies in mass change-outs, London Hydro found it could offer incentives equivalent to 25 percent of the cost of the replacement refrigerator. This made the investment in new equipment attractive to the property manager while keeping the cost of energy saved well below the cost of generation. On average, London Hydro offered an incentive of $133 for each replacement refrigerator. Multi-family building owners' participation fell off dramatically after the first year, leading program managers to conclude that this portion of the program offers large, but one-time only, savings.

For more information on the Chill Out London program, visit www.chill-out.ca/terms.html.

FULL RECYCLING DELIVERS GREATER CARBON SAVINGS

The global warming potential of refrigerators is reduced most when a refrigerator is fully recycled. Federal law stipulates that refrigerants, most often CFCs and HCFCs, must be recovered before dismantling or disposing of a refrigerator. It does not, however, require the recovery of the CFCs or HCFCs that are used as blowing agents and are trapped in the foam, nor does it require that the casing material (metal, plastic and glass) be recycled. Full recovery of the foam and recycling of the casing will nearly double the expected reduction in claimable global warming potential over simple recovery of the refrigerant.[13]

Carbon Savings Per Unit from Refrigerator Recycling



Note: This calculation of per-unit refrigerator recycling carbon savings assumes the refrigerator has six years of remaining life and consumes 661 kWh per year.

Source: D&R International, based on "Responsible Appliance Disposal Program 2007 Annual Report," U.S. Environmental Protection Agency; "Evaluation Study of the 2004-2005 Statewide Residential Appliance Recycling Program," California Public Utilities Commission, April 2008.

Endnotes

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c. Dohrmann et al., "Net Savings Estimation in Appliance Recycling Programs: A Review and Empirical Analysis with Recent California Data," 2007 IEPEC Conference. Net-to-gross value range of 0.42 to 0.64.

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