

# California Residential Efficiency Market Share Tracking

## Appliances 2003

Prepared for:

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# 1

## Introduction

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This report summarizes the analysis and results of the appliances component of the California Residential Market Share Tracking project (RMST). Ongoing since 1999, the California RMST has tracked the average efficiencies and share of energy efficient appliances, heating and cooling equipment, and lamps sold for use in California's residential sector.<sup>1,2</sup> Itron Inc. conducts the California RMST for the state's three electric investor-owned utilities (IOUs). This project is managed by Southern California Edison.<sup>3</sup>

This report presents the total estimated unit sales, average energy efficiency ratings, and percent of ENERGY STAR<sup>®</sup> qualified clothes washers, refrigerators, dishwashers, and room air conditioners sold in the state from 1998 through 2003. Results are presented by IOU service area, aggregated service areas, and/or retailer type (national chain versus independent retailer) if the data can support such segmentation. This report also contains a review of data collection and analysis methodologies, general market information, and summaries of applicable efficiency standards for each appliance type, including federal energy use standards, national ENERGY STAR program standards, and California's appliance efficiency standards.

The information presented herein, such as trends in share of ENERGY STAR qualified appliances sold for each appliance type tracked in the RMST, is especially relevant for program administrators like the California IOUs that have adopted the ENERGY STAR platform for their appliance programs. California's statewide appliance program uses the ENERGY STAR threshold as the qualifying criterion for appliance eligibility and has partnered with the federal ENERGY STAR program for marketing and outreach. The share of ENERGY STAR qualifying appliances sold in the state is therefore a valuable indicator of program success and is used to support the evaluation of the statewide program.

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<sup>1</sup> All RMST reports can be downloaded from <http://www.calmac.org/>.

<sup>2</sup> Separate annual reports and high level summaries are produced for each of these three measure types.

<sup>3</sup> RER was acquired by Itron on September 30, 2002. This date comes from Itron's press release dated 9/10/2002.

The remainder of this report is organized as follows.

- Section 2 details the data collection and analysis methodology for developing the market share and average efficiency estimates.
- Section 3 presents the results for clothes washers.
- Section 4 presents the results for dishwashers.
- Section 5 presents the results for refrigerators.
- Section 6 presents the results for room air conditioning.
- Section 7 provides a summary of work in progress for the 2004 RMST data analysis.

# 2

## Data Collection and Analysis

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### 2.1 Overview

The appliance component of the RMST estimates the share of ENERGY STAR qualified units sold and average efficiency ratings from retailer sales data. In general, the appliance retail market is comprised of two retailer types: national chain stores and independently owned retailers (including regional appliance chains and single storefronts). To accurately reflect appliance market trends, it is important that data be obtained from a representative sample of both retailer types. Since the inception of the RMST, Itron has obtained sales data from a panel of independent appliance retailers throughout California. Data from national appliance retailers is provided by D&R International, a firm under contract with the DOE to administer the federal ENERGY STAR appliance program.<sup>4</sup>

The remainder of this section provides an overview of California's appliance retail market and describes the data collection and analysis methodologies. Appendix A provides a more technical description of the sales data analysis.

### 2.2 California's Appliance Retail Market

The analysis of appliance sales relies on collecting data from a representative sample of appliance retailers. It is therefore important to understand the number of appliance retail storefronts in California. Table 2-1 summarizes the quantity of appliance retailers as well as the total number of storefronts.

The table distinguishes between national chain stores and independent retailers in the California appliance market. As mentioned previously, independent appliance retailers include single storefronts (mom-and-pop stores) as well as regional chains.

As shown, all national chain storefronts are currently ENERGY STAR partners. Previous research has shown that, overall, national chains sell about half of the appliances in

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<sup>4</sup> It is important to note that not all national ENERGY STAR partners share appliance sales data with D&R International.

California. Independent retailers sell the remaining half. When breaking down sales by appliance, however, the percentage of sales between these two market channels varies.

D&R International currently collects data from approximately 29% of the national appliance retailer storefronts. Additionally, Itron collects data from 18 independent storefronts (of the 415 total independent storefronts across the state) to track sales of energy efficient appliances in California.

**Table 2-1: California Appliance Retailers – 2003**

|                                   | <b>National<br/>Chains</b> | <b>Independent<br/>Regional Chains</b> | <b>Independent<br/>Individual Stores</b> | <b>All<br/>Retailers</b> |
|-----------------------------------|----------------------------|--|--|--------------------------|
| Companies                         | 6                          | 32                                     | 300                                      | 338                      |
| ENERGY STAR Partners <sup>2</sup> | 6                          | 1                                      | 0  | 7                        |
| Retail Storefronts <sup>1</sup>   | 520                        | 115                                    | 300                                      | 935                      |

1. Costco and Sam’s Club Membership Warehouses are included in this data since these storefronts have entered the home appliance market. The total number of California retail storefronts was confirmed through Internet research of national chain websites or through discussions with investor relations offices of national chains in California.
2. All national chain storefronts participate in the ENERGY STAR program once the corporate home office has agreed to participate in the program. Individual storefronts do not make the decision regarding participation.

### **2.3 National Appliance Retailer Sales Data**

D&R International (D&R) collects sales data from national retailers under a contract to support and evaluate the ENERGY STAR appliance program and to track sales of ENERGY STAR labeled products on a national level. To support the RMST, D&R has provided Itron with general sales data from national retail chains for each of the appliances covered by the RMST project. The national chain ENERGY STAR partners in the 2003 D&R data include two national retail entities. Note, however, that there have been changes over the past six years in the retailers that have provided data for D&R’s database.<sup>5</sup>

D&R’s database of 2003 data includes the total number of all units sold by zip code and the total number of ENERGY STAR qualifying units sold by zip code. D&R is not able to provide more detailed information about specific efficiency characteristics of the units sold.

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<sup>5</sup> Two national chains provided 1998 data, four provided 1999 data, and two provided complete 2000-2003 data. Appendix A presents further information on methodology used in weighting the national chain data.

## 2.4 Independent and Regional Chain Appliance Retailer Sales Data

To represent trends of appliance sales through independently owned storefronts and regional chains, Itron collects data from a panel of independent retailers throughout California. The sampling strategy, recruiting strategy, and characteristics of the 2003 retailer panel are described below. Additionally, this section contains information about the ENERGY STAR sales by independent retailers.

### Sample Frame and Sample Design

The sample frame of independent retailers used for this study was mainly drawn from a list provided by the Electric and Gas Industries Association (EGIA). Independent research by the project team also supplemented the EGIA information.<sup>6</sup> Table 2-2 illustrates the breakdown of storefronts by utility area.

Table 2-3 provides the sample targets for each utility service area for the 2003 report.

**Table 2-2: Independent Appliance Retailer Sample Frame**

|  | Utility Service Area |     |       |                    | Total |
|--|----------------------|-----|-------|--------------------|-------|
|  | PG&E                 | SCE | SDG&E | Other <sup>1</sup> |       |
| <b>All Areas</b>                         |                      |     |       |                    |       |
| Storefronts                              | 209                  | 99  | 35    | 72                 | 415   |
| Percent of Total                         | 50%                  | 25% | 8%    | 17%                | 100%  |
| <b>PG&amp;E, SCE, and SDG&amp;E Only</b> |                      |     |       |                    |       |
| Storefronts                              | 208                  | 98  | 34    |                    | 340   |
| Percent of Total                         | 61%                  | 29% | 10%   |                    | 100%  |

1. "Other" includes the service territories of municipal utilities such as LADWP, SMUD, LMUD, and others.

**Table 2-3: Independent Appliance Retailer Sample Targets**

|                  | Utility Service Area |     |       | Total |
|------------------|----------------------|-----|-------|-------|
|                  | PG&E                 | SCE | SDG&E |       |
| Storefronts      | 39                   | 19  | 7     | 65    |
| Percent of Total | 60%                  | 30% | 10%   | 100%  |

<sup>6</sup> The 2002 sample obtained from the EGIA under-represented the SDG&E service area, according to EGIA staff. Augmenting the EGIA sample with Associated Volume Buyers (AVB) members helped to alleviate this problem.



**Independent Retailer Panel Recruitment**

Efforts to recruit appliance retailers for the RMST have been ongoing since the beginning of the project. Iron enters a confidentiality agreement with each retailer. Retailers are not obligated to provide data for a specified period of time, nor are they required to provide sales data in a pre-specified format.

The number of retailers in the independent retailer panel has varied from year to year. Recruitment efforts during 2001 substantially increased the sample size over that of the previous year, as well as improved ease of participation. However, the participation level decreased in both 2002 and 2003. This was due in part to the inability of some retailers to provide the sales data in a timeframe compatible with the reporting process.

**Current Independent Retailer Panel**

As shown in Table 2-4, the 2003 independent retailer panel included 18 individual storefronts, representing a panel of six independent retailers. As always, data continue to be updated whenever possible, and subsequent reports will contain the most recent data from these retailers. The retailers in the panel provided data in various formats: electronic spreadsheets, hard-copy sales reports, and handwritten tallies of units sold. Most retailers provide monthly sales data that includes the appliance type, manufacturer, manufacturer model number, quantity sold, and date of sale.

**Table 2-4: Current Independent Appliance Retailer Panel**

|                  | Utility Service Area |                     |       | All  |
|------------------|----------------------|---------------------|-------|------|
|                  | PG&E                 | Southern California | Other |      |
| Storefronts      | 17                   | 0                   | 1     | 18   |
| Percent of Total | 94%                  | 0%                  | 6%    | 100% |

**Summary of 2003 Database Coverage**

Table 2-5 summarizes the RMST coverage of units sold in 2003 by appliance type. As shown, the 2003 database includes sales data for 39% of the total number of clothes washers, 28% of dishwashers, 47% of refrigerators, and 12% of room air conditioners sold in California.

**Table 2-5: 2003 Coverage of Units Sold, by Appliance Type**

|                  | Appliance Type  |             |               |         |
|------------------|-----------------|-------------|---------------|---------|
|                  | Clothes Washers | Dishwashers | Refrigerators | Room AC |
| Unit Sales       | 345,297         | 197,813     | 581,712       | 62,603  |
| Percent of Total | 39%             | 28%         | 47%           | 12%     |

### ***ENERGY STAR Sales by Independent Retailers***

In California, independent retailers have secured a substantial market share in the overall appliance market. The results of this study continue to demonstrate that independent retailers generally sell a larger proportion of ENERGY STAR qualified appliances than national chain appliance retailers. This difference could be attributable to several factors, including lower employee turnover and therefore higher awareness, willingness to special order appliances, and overall different marketing strategies. Additionally, independent appliance retailers may cater to a different clientele that is more likely to purchase the higher end, and sometimes higher efficiency, product.

Moreover, independent stores do not try to compete with the price points that national chain stores offer on some models. Instead, they tend to focus on service, knowledge, and helping to find the best fit for the needs of a customer as their customers are often looking for planned appliance replacements. This stands in contrast to some customers who may seek out a national chain because they require an emergency appliance replacement purchase.

In the past, national chain stores' appliance selection was limited in comparison to independent appliance retailers, which typically offered a greater selection to consumers. However, national chains have improved their ENERGY STAR product lines, and their market share of these items has increased in California.

## **2.5 Analysis Approach**

The analysis for the appliance component of the RMST includes the estimation of the share of ENERGY STAR qualified units sold and the estimation of average efficiency of all units sold. For all appliances, the market share of ENERGY STAR qualified appliances is presented by market channel and by utility service area. Average energy factors (EF) are calculated for clothes washers, dishwashers, and refrigerators. Both types of results are reported on an annual and quarterly basis. A brief description of both approaches is presented below. More detailed descriptions are provided in Appendix A.

### ***ENERGY STAR Market Share Analysis***

The share of ENERGY STAR qualified units sold is estimated with sales data from both national chains and independent retailers. This statistic is based on whether an appliance sold in California met the qualifications for the ENERGY STAR program. Therefore, the resulting market shares will be affected when the federal ENERGY STAR specifications are revised. (For example, the impact of ENERGY STAR specification changes on market share was evident in 2001 when the efficiency standard for ENERGY STAR for refrigerators increased and the share of ENERGY STAR refrigerators sold dropped from 34.9% to only

1.4%) While this analysis reflects the overall market penetration of the ENERGY STAR brand, it does not track or evaluate the actual efficiencies of the units sold. It is also important to note that the analysis examines appliances that would qualify for an ENERGY STAR label based on efficiency levels and rather than actual possession of the ENERGY STAR label or inclusion on the national ENERGY STAR list of qualified appliances.

The following sections summarize the current efficiency levels required to qualify for the ENERGY STAR label and highlight any relevant changes to the standards that occurred within the reporting period.

### ***Energy Factor Analysis***

In contrast to the ENERGY STAR analysis described above, the EF analysis presents the actual average energy efficiencies of appliances sold throughout the state. It is important to note that average efficiencies can only be estimated from data obtained by independent appliance retailers. The sales data from national chains provided by D&R does not include the EF information nor the model numbers of units sold, which would enable national chain sales data to be included in this analysis. The EF results are presented for clothes washers, dishwashers and refrigerators.<sup>7</sup> Each section summarizes how the EF is calculated for each appliance type. Within each appliance type, the higher the EF, the more efficient the unit. Since EFs cannot be compared between appliances, only within appliance types, it is not accurate to conclude that refrigerators are more efficient than dishwashers since the average EF of refrigerators is higher than the average EF of dishwashers.

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<sup>7</sup> Room air conditioners use a different type of rating, called an Energy Efficiency Rating (EER), and therefore energy factors were not calculated for this appliance.

# 3

## Clothes Washers

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### 3.1 Overview

This section presents the results for residential clothes washers. Subsections 3.2 and 3.3 provide estimates of total clothes washer unit sales and summarize relevant energy efficiency standards, respectively. Subsection 3.3 provides estimates of the share of ENERGY STAR qualified clothes washers sold in California from 1998 through 2003. Subsection 3.4 presents estimates of average EFs of clothes washers sold through independent retailers during the same period.

### 3.2 Total Unit Sales

Table 3-1 presents estimates of annual unit sales of residential clothes washers in California from 1998 through 2003.

**Table 3-1: Estimate of Total Clothes Washer Unit Sales in California**

| Measure         | 1998    | 1999    | 2000    | 2001    | 2002    | 2003    |
|-----------------|---------|---------|---------|---------|---------|---------|
| Clothes Washers | 702,000 | 721,100 | 731,500 | 766,500 | 819,500 | 881,500 |

Source: AHAM

### 3.3 Clothes Washer Energy Efficiency Standards

Clothes washer efficiency ratings are based on estimated annual energy use (kWh) under “typical conditions” and an average of 392 loads, or cycles, per year. In general, the efficiency ratings for clothes washers are expressed in terms of ft<sup>3</sup>/kWh/cycle.

The EF rating is computed as the capacity in cubic feet (C) divided by the sum of the machine electrical energy for the mechanical action of a cycle (M) and the water heating energy required for a cycle (E):

$$EF = \frac{C}{M + E}$$

**Federal Energy Use Standard.** Under the 1994 federal EF standard top-loading clothes washers with a tub capacity of 1.6 cubic feet or greater were required to have an EF of at least 1.18. The requirements for front-loading units included an unheated rinse option.

The federal energy use standards for clothes washers changed on January 1, 2004. The current standard reflects a switch to a modified energy factor (MEF) performance metric, from the previous EF-based standard.<sup>8</sup> The MEF rating is the quotient of the capacity of the clothes washer in cubic feet (C) divided by the total clothes washer energy use in kWh per cycle. The total annual energy usage defined as the sum of the machine electrical energy consumption (M), the hot water energy consumption (E), and the energy required for removal of the remaining moisture in the wash load (D).<sup>9</sup>

$$\text{MEF} = \frac{C}{M + E + D}$$

Under the current federal energy use standards, clothes washers are required to have a MEF of 1.04 or greater.

The switch to use of the MEF was guided, in part, by the Super-Efficient Home Appliance Initiative (SEHA) standards created by the Consortium for Energy Efficiency (CEE). The changes to the federal energy use standards also mandate a second increase in the standard, to become effective January 1, 2007. The new standards will require units to be 22% more efficient in 2004 and 35% more efficient in 2007 than 2001's baseline washer.

**ENERGY STAR Standard.** Effective January 1, 2004, the ENERGY STAR standard was also revised to reflect the changes in the federal energy use standards. The new ENERGY STAR criteria required that all qualified products possess a MEF of 1.42 or greater.

Table 3-2 summarizes the federal, state, and ENERGY STAR standards for clothes washers.

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<sup>8</sup> [http://www.energystar.gov/index.cfm?c=clotheswash.pr\\_crit\\_clothes\\_washers](http://www.energystar.gov/index.cfm?c=clotheswash.pr_crit_clothes_washers)

<sup>9</sup> The MEF considers the moisture content remaining in clothes after washing in order to correlate the effectiveness of the washer to the amount of dryer use required or, in other words, the dryer savings.

**Table 3-2: Comparison of Federal and ENERGY STAR Clothes Washer Energy Standards**

|                             | 1994 Standard | January 1, 2001 Standard | January 1, 2004 Standard | January 1, 2007 Standard |
|-----------------------------|---------------|--------------------------|--------------------------|--------------------------|
| <b>Federal Standard</b>     | 1.18 EF       | 1.18 EF                  | 1.04 MEF                 | 1.26 MEF                 |
| Percent Improved            | N/A           | N/A                      | 22% over 2001            | 35% over 2001            |
| <b>ENERGY STAR Standard</b> | 2.50 EF       | 1.26 MEF (~ 2.50 EF)     | 1.42 MEF                 | N/A                      |
| <b>California Standard</b>  | 1.18 EF       | 1.18 EF                  | 1.04 MEF                 | 1.26 MEF                 |

Note that the clothes washer sales data presented in the current report were analyzed under the EF standard that was in effect from May 1994 to December 2003 since the current report only addresses sales data and efficiency trends through 2003. The analysis of 2004 data will adopt the MEF-based standard.

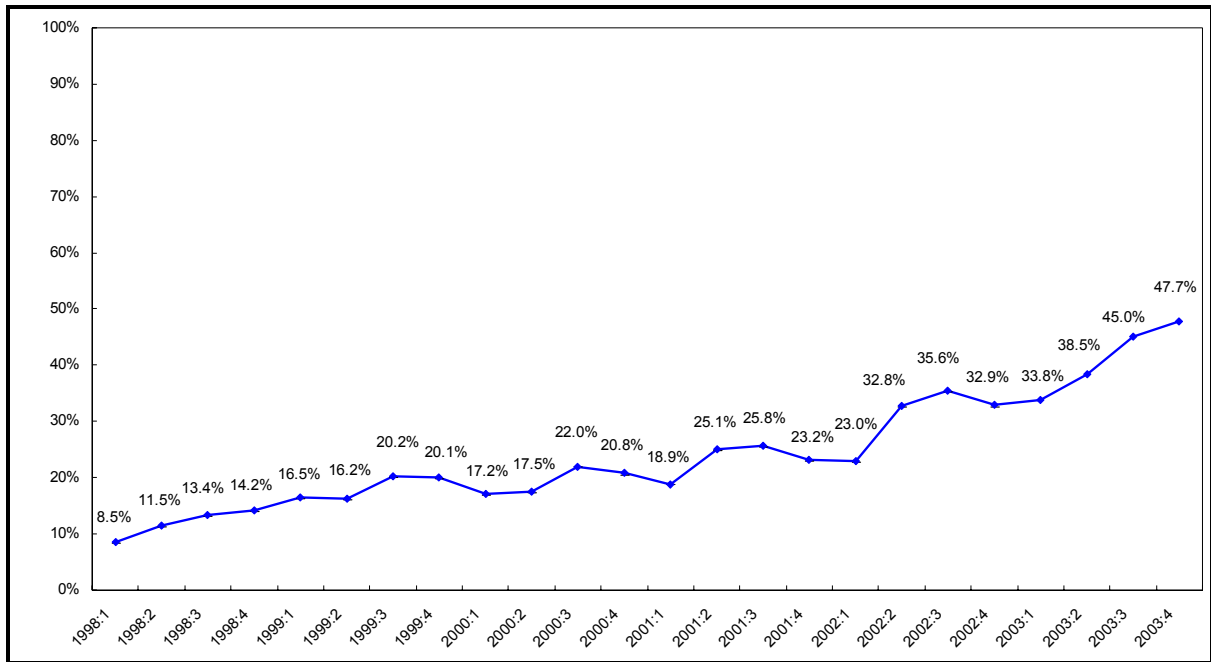
### 3.4 Market Share of ENERGY STAR Qualified Clothes Washers

Figure 3-1 and Table 3-3 present the percentage of ENERGY STAR qualified clothes washers sold in California from the first quarter of 1998 through the fourth quarter of 2003.<sup>10</sup> As shown, the market share of ENERGY STAR qualified clothes washers has increased during the past six years—climbing from a low of 8.5% in the first quarter of 1998 to over 47.7% during the fourth quarter of 2003.

Table 3-4 reports the percentage of ENERGY STAR compliant clothes washers sold in each utility service area on an annual and quarterly basis. As shown, PG&E’s service territory exhibited the highest percentage of ENERGY STAR clothes washer sales in 2003, at 45.5%. Sales in the SDG&E and SCE service represented the next highest percentage of ENERGY STAR clothes washer sales in 2003, at 39.7% and 39.2%, respectively. The “Other” service territory reported the lowest proportion of ENERGY STAR unit sales in 2003, at 35.8%.

<sup>10</sup> In Figure 3-1, Table 3-3, and Table 3-4, data from 1998 reflect national chain D&R data only. Because of this and the adjustments made to better estimate 1998 results, standard errors for 1998 are not listed.

Figure 3-1: Clothes Washer Sales, Percent of ENERGY STAR Qualified Units



Error bands for the 90% confidence interval.

**Table 3-3: Clothes Washer Sales, Percent of ENERGY STAR Qualified Units (Statewide)**

| Year | Percent of ENERGY STAR Qualified Clothes Washers |  |  |  |  |
|------|--|--|--|--|--|
|      | Annual   | Q1                                       | Q2                                       | Q3                                       | Q4                                       |
| 1998 | <b>11.96%</b><br>(-)<br>n = 180,983              | <b>8.52%</b><br>(-)<br>n = 44,233        | <b>11.46%</b><br>(-)<br>n = 43,366       | <b>13.39%</b><br>(-)<br>n = 44,746       | <b>14.22%</b><br>(-)<br>n = 48,638       |
| 1999 | <b>18.17%</b><br>(0.0006)<br>n = 425,528         | <b>16.45%</b><br>(0.0011)<br>n = 115,621 | <b>16.23%</b><br>(0.0011)<br>n = 107,984 | <b>20.24%</b><br>(0.0013)<br>n = 101,691 | <b>20.07%</b><br>(0.0013)<br>n = 100,232 |
| 2000 | <b>19.26%</b><br>(.0006)<br>n=414,505            | <b>17.20%</b><br>(.0013)<br>n=113,966    | <b>17.48%</b><br>(.0011)<br>n=114,385    | <b>22.01%</b><br>(.0011)<br>n=88,754     | <b>20.79%</b><br>(.0014)<br>n=97,400     |
| 2001 | <b>23.17%</b><br>(0.0006)<br>n = 427,489         | <b>18.88%</b><br>(0.0012)<br>n = 109,184 | <b>25.06%</b><br>(0.0013)<br>n = 103,324 | <b>25.78%</b><br>(0.0014)<br>n = 103,185 | <b>23.16%</b><br>(0.0013)<br>n = 111,796 |
| 2002 | <b>30.58%</b><br>(0.0007)<br>n = 462,069         | <b>23.04%</b><br>(0.0011)<br>n = 150,430 | <b>32.82%</b><br>(0.0014)<br>n = 108,486 | <b>35.58%</b><br>(0.0015)<br>n = 102,046 | <b>32.89%</b><br>(0.0015)<br>n = 101,107 |
| 2003 | <b>41.47%</b><br>(0.0008)<br>n = 345,297         | <b>33.77%</b><br>(0.0014)<br>n = 108,379 | <b>38.50%</b><br>(0.0018)<br>n = 76,204  | <b>45.01%</b><br>(0.0018)<br>n = 76,179  | <b>47.74%</b><br>(0.0017)<br>n = 84,535  |

Standard errors in parentheses.



**Table 3-4: Clothes Washer Sales, Percent of ENERGY STAR Qualified Units by Utility Service Area**

| Utility            | Year | Percent of ENERGY STAR Qualified Clothes Washers |                                |                                |                                |                                |
|--------------------|------|--|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
|                    |      | Annual   | Q1                             | Q2                             | Q3                             | Q4                             |
| PG&E               | 1998 | 12.65%<br>(-)<br>n=83,563                        | 80.63%<br>(-)<br>n=19,916      | 13.65%<br>(-)<br>n=20,751      | 15.29%<br>(-)<br>n=20,520      | 12.87%<br>(-)<br>n=22,376      |
|                    | 1999 | 14.68%<br>(0.0008)<br>n=165,144                  | 12.91%<br>(0.0015)<br>n=47,436 | 13.67%<br>(0.0017)<br>n=42,090 | 15.56%<br>(0.0019)<br>n=37,916 | 17.16%<br>(0.0019)<br>n=37,702 |
|                    | 2000 | 24.29%<br>(.0011)<br>n=165,405                   | 20.36%<br>(.0019)<br>n=43,959  | 23.99%<br>(.0020)<br>n=45,042  | 28.1%<br>(.0023)<br>n=37,038   | 25.04%<br>(.0022)<br>n=39,366  |
|                    | 2001 | 29.47%<br>(0.0011)<br>n=170,360                  | 23.47%<br>(0.0020)<br>n=43,035 | 31.08%<br>(0.0023)<br>n=40,366 | 32.72%<br>(0.0023)<br>n=41,868 | 30.68%<br>(0.0022)<br>n=45,091 |
|                    | 2002 | 36.68%<br>(0.0012)<br>n=170,593                  | 30.34%<br>(0.0020)<br>n=53,861 | 39.78%<br>(0.0025)<br>n=39,911 | 41.30%<br>(0.0025)<br>n=38,456 | 37.62%<br>(0.0025)<br>n=38,365 |
|                    | 2003 | 45.52%<br>(0.0014)<br>n=128,897                  | 39.77%<br>(0.0024)<br>n=41,517 | 43.32%<br>(0.0030)<br>n=28,070 | 46.41%<br>(0.0030)<br>n=28,465 | 54.65%<br>(0.0028)<br>n=30,845 |
| SCE                | 1998 | 8.74%<br>(-)<br>n=47,708                         | 7.55%<br>(-)<br>n=12,287       | 7.16%<br>(-)<br>n=11,357       | 7.88%<br>(-)<br>n=11,693       | 12.19%<br>(-)<br>n=12,371      |
|                    | 1999 | 17.38%<br>(0.0010)<br>n=140,863                  | 15.59%<br>(0.0018)<br>n=36,820 | 15.41%<br>(0.0019)<br>n=35,609 | 19.73%<br>(0.0021)<br>n=34,829 | 19.03%<br>(0.0021)<br>n=33,605 |
|                    | 2000 | 14.95%<br>(.0009)<br>n=136,046                   | 14.06%<br>(.0018)<br>n=38,696  | 12.21%<br>(.0017)<br>n=38,212  | 16.75%<br>(.0022)<br>n=27,790  | 17.25%<br>(.0021)<br>n=31,348  |
|                    | 2001 | 18.99%<br>(0.0010)<br>n=144,802                  | 15.86%<br>(0.0019)<br>n=37,341 | 21.10%<br>(0.0022)<br>n=35,457 | 21.71%<br>(0.0022)<br>n=34,187 | 17.57%<br>(0.0019)<br>n=37,817 |
|                    | 2002 | 28.52%<br>(0.0011)<br>n=157,803                  | 20.50%<br>(0.0018)<br>n=51,295 | 30.10%<br>(0.0024)<br>n=37,933 | 32.90%<br>(0.0025)<br>n=34,570 | 31.94%<br>(0.0025)<br>n=34,005 |
|                    | 2003 | 39.21%<br>(0.0014)<br>n=117,280                  | 24.80%<br>(0.0023)<br>n=36,021 | 35.65%<br>(0.0029)<br>n=26,493 | 44.29%<br>(0.0031)<br>n=25,888 | 43.93%<br>(0.0029)<br>n=28,878 |
| SDG&E              | 1998 | 11.70%<br>(-)<br>n=14,582                        | 10.59%<br>(-)<br>n=3,491       | 11.65%<br>(-)<br>n=3,359       | 14.19%<br>(-)<br>n=3,413       | 10.66%<br>(-)<br>n=4,319       |
|                    | 1999 | 18.03%<br>(0.0020)<br>n=38,302                   | 18.67%<br>(0.0039)<br>n=9,915  | 14.68%<br>(0.0035)<br>n=9,943  | 18.70%<br>(0.0041)<br>n=9,229  | 20.18%<br>(0.0042)<br>n=9,215  |
|                    | 2000 | 21.29%<br>(.0022)<br>n=35,560                    | 19.91%<br>(.0040)<br>n=9,890   | 16.25%<br>(.0037)<br>n=9,816   | 24.36%<br>(.0050)<br>n=7,492   | 24.72%<br>(.0047)<br>n=8,362   |
|                    | 2001 | 18.17%<br>(0.0020)<br>n=39,016                   | 14.20%<br>(0.0035)<br>n=9,835  | 18.73%<br>(0.0040)<br>n=9,592  | 18.67%<br>(0.0040)<br>n=9,621  | 21.07%<br>(0.0041)<br>n=9,968  |
|                    | 2002 | 25.53%<br>(0.0023)<br>n=37,314                   | 16.80%<br>(0.0036)<br>n=12,438 | 27.26%<br>(0.0048)<br>n=8,668  | 31.26%<br>(0.0050)<br>n=8,513  | 31.33%<br>(0.0053)<br>n=7,695  |
|                    | 2003 | 39.73%<br>(0.0031)<br>n=24,164                   | 33.70%<br>(0.0052)<br>n=8,223  | 34.19%<br>(0.0067)<br>n=5,046  | 47.42%<br>(0.0069)<br>n=5,181  | 46.34%<br>(0.0066)<br>n=5,714  |
| Other <sup>1</sup> | 1998 | 13.37%<br>(-)<br>n=35,130                        | 7.82<br>(-)<br>n=8,539         | 10.36%<br>(-)<br>n=7,899       | 14.39%<br>(-)<br>n=9,120       | 19.82%<br>(-)<br>n=9,57203     |
|                    | 1999 | 15.71%<br>(0.0013)<br>n=81,219                   | 14.65%<br>(0.0024)<br>n=21,450 | 14.91%<br>(0.0025)<br>n=20,342 | 17.67%<br>(0.0027)<br>n=19,717 | 15.72%<br>(0.0026)<br>n=19,710 |
|                    | 2000 | 16.20%<br>(.0013)<br>n=77,494                    | 16.02%<br>(.0025)<br>n=21,421  | 15.11%<br>(.0025)<br>n=21,315  | 17.47%<br>(.0030)<br>n=16,434  | 16.43%<br>(.0027)<br>n=18,324  |
|                    | 2001 | 22.03%<br>(0.0015)<br>n=73,311                   | 18.51%<br>(0.0028)<br>n=18,973 | 25.02%<br>(0.0032)<br>n=17,909 | 23.20%<br>(0.0032)<br>n=17,509 | 21.58%<br>(0.0030)<br>n=18,920 |
|                    | 2002 | 21.43%<br>(0.0013)<br>n=96,359                   | 13.98%<br>(0.0019)<br>n=32,836 | 23.25%<br>(0.0028)<br>n=21,974 | 27.84%<br>(0.0031)<br>n=20,507 | 24.90%<br>(0.0030)<br>n=21,042 |
|                    | 2003 | 35.84%<br>(0.0018)<br>n=74,956                   | 27.63%<br>(0.0030)<br>n=22,618 | 32.05%<br>(0.0036)<br>n=16,595 | 42.82%<br>(0.0038)<br>n=16,645 | 42.79%<br>(0.0036)<br>n=19,098 |

1. "Other" includes municipal utilities, including LADWP, SMUD, and others.

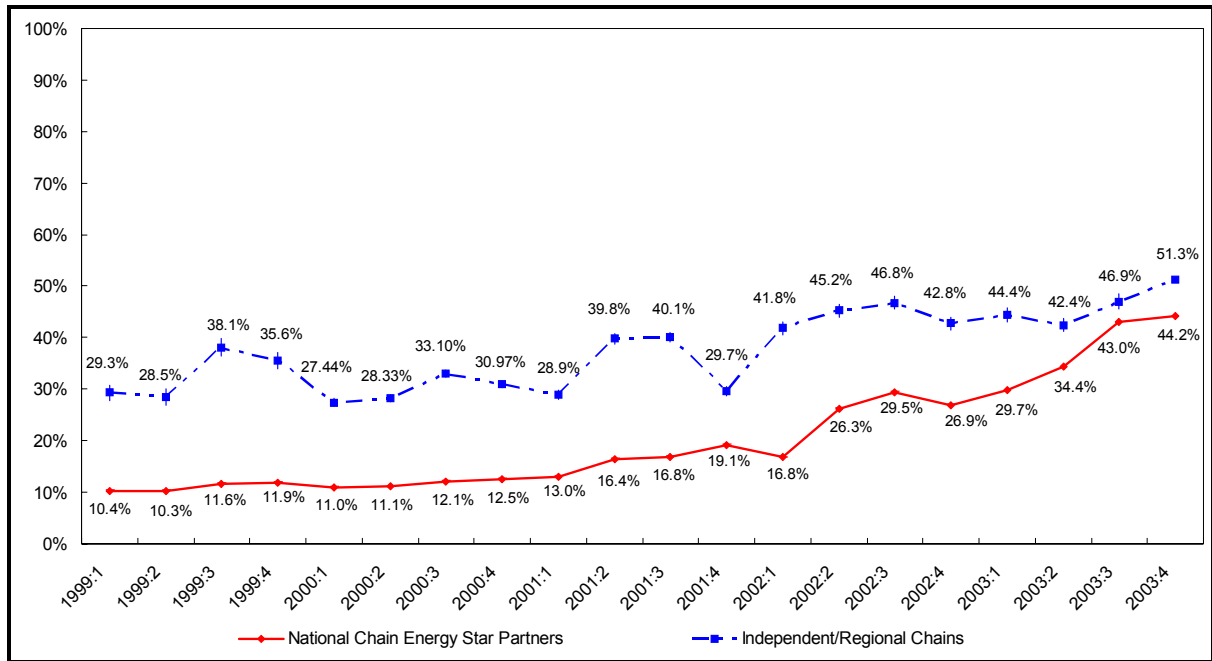
### 3.5 Analysis by Market Channel

#### Comparison of Sales Data from National Chains and Independent Retailers

Figure 3-2 and Table 3-5 compare the shares of ENERGY STAR qualified clothes washers sold through national chain ENERGY STAR partners to sales by independently owned stores and regional chains. As shown, national chains have consistently sold a lower percentage of ENERGY STAR clothes washers than independent retailers, though the difference has narrowed over time, reaching a five-year low of 3.9% in the third quarter of 2003.

From 1999 through 2003, the share sold by national chain ENERGY STAR partners more than quadrupled, growing from 10% in the first quarter of 1999 to 44% by the last quarter of 2003. During the same period, the independent appliance retailers also experienced a growth in share, although their share fluctuated more widely than the share of the national chain ENERGY STAR partners. The five-year lowest share for independents occurred in the first quarter of 2000, at 27.4%, whereas the highest share for independents occurred in the fourth quarter of 2003, at 51.3%.

**Figure 3-2: Clothes Washer Sales, Percent of ENERGY STAR Qualified Units by Market Channel**



Error bands for the 90% confidence interval.

**Table 3-5: Clothes Washer Sales, Percent of ENERGY STAR Qualified Units by Market Channel**

| Year/Quarter | Market Channel                      |                                  |
|--------------|-------------------------------------|----------------------------------|
|              | National Chain ENERGY STAR Partners | Independent and Regional Chains  |
| 1999:1       | 10.36%<br>(0.0009)<br>n = 113,050   | 29.28%<br>(0.0090)<br>n = 2,571  |
| 1999:2       | 10.30%<br>(0.0009)<br>n = 105,551   | 28.47%<br>(0.0091)<br>n = 2,433  |
| 1999:3       | 11.63%<br>(0.0010)<br>n = 99,385    | 38.10%<br>(0.0101)<br>n = 2,306  |
| 1999:4       | 11.88%<br>(0.0010)<br>n = 97,766    | 35.58%<br>(0.0096)<br>n = 2,466  |
| 2000:1       | 10.98%<br>(0.0010)<br>n = 102,845   | 27.44%<br>(0.0042)<br>n = 11,121 |
| 2000:2       | 11.05%<br>(0.0010)<br>n = 103,399   | 28.33%<br>(0.0043)<br>n = 10,986 |
| 2000:3       | 12.12%<br>(0.0012)<br>n = 76,422    | 33.09%<br>(0.0042)<br>n = 12,332 |
| 2000:4       | 12.48%<br>(0.0011)<br>n = 85,304    | 30.97%<br>(0.0042)<br>n = 12,096 |
| 2001:1       | 12.98%<br>(0.0011)<br>n = 102,255   | 28.90%<br>(0.0054)<br>n = 6,929  |
| 2001:2       | 16.40%<br>(0.0012)<br>n = 96,959    | 39.81%<br>(0.0061)<br>n = 6,365  |
| 2001:3       | 16.84%<br>(0.0012)<br>n = 96,088    | 40.06%<br>(0.0058)<br>n = 7,097  |
| 2001:4       | 19.07%<br>(0.0012)<br>n = 104,159   | 29.65%<br>(0.0052)<br>n = 7,637  |
| 2002:1       | 16.77%<br>(0.0010)<br>n = 146,565   | 41.83%<br>(0.0079)<br>n = 3,865  |
| 2002:2       | 26.27%<br>(0.0014)<br>n = 104,567   | 45.22%<br>(0.0080)<br>n = 3,919  |
| 2002:3       | 29.46%<br>(0.0015)<br>n = 97,998    | 46.77%<br>(0.0078)<br>n = 4,048  |
| 2002:4       | 26.90%<br>(0.0014)<br>n = 96,899    | 42.76%<br>(0.0076)<br>n = 4,208  |
| 2003:1       | 29.74%<br>(0.0014)<br>n = 104,513   | 44.44%<br>(0.0080)<br>n = 3,866  |
| 2003:2       | 34.39%<br>(0.0018)<br>n = 72,203    | 42.40%<br>(0.0078)<br>n = 4,001  |
| 2003:3       | 43.01%<br>(0.0018)<br>n = 73,121    | 46.95%<br>(0.0090)<br>n = 3,058  |
| 2003:4       | 44.21%<br>(0.0017)<br>n = 81,331    | 51.26%<br>(0.0088)<br>n = 3,204  |

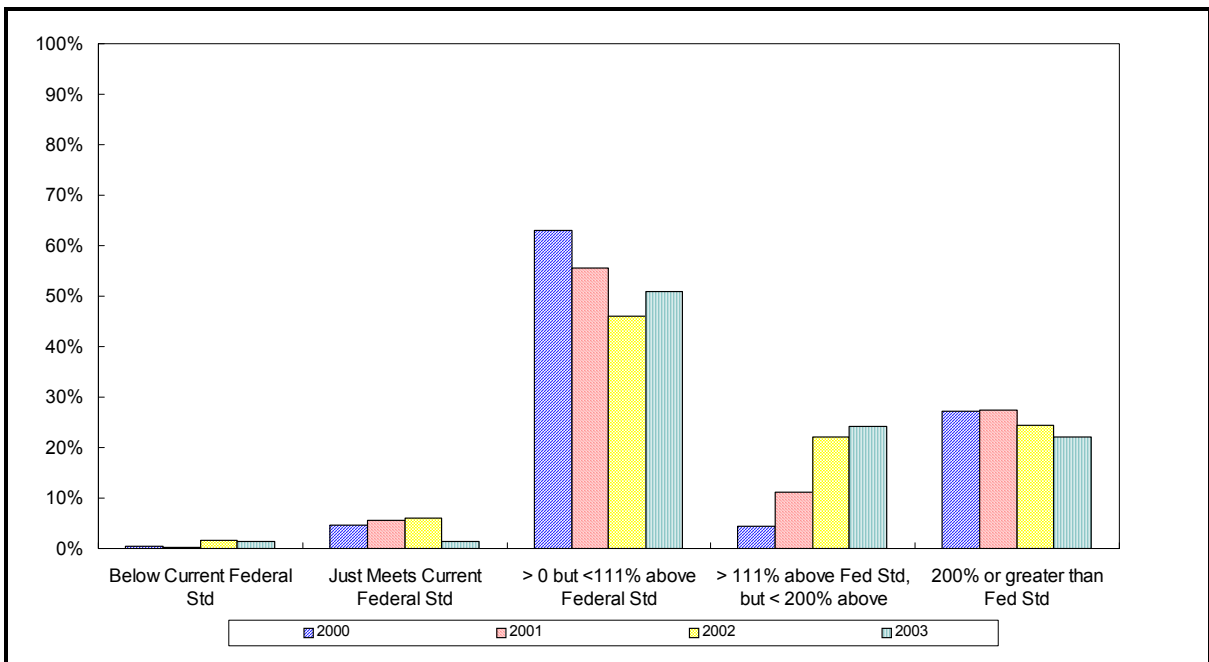
Standard errors in parentheses.

**Energy Factor Analysis**

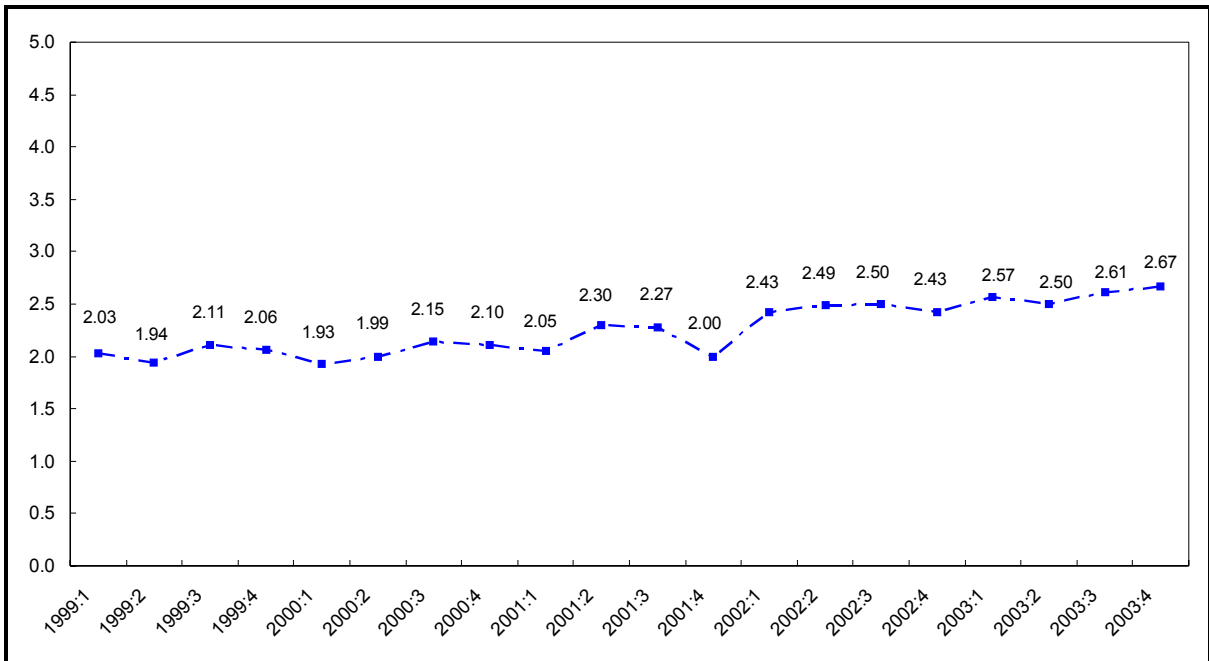
Figure 3-3 illustrates sales by independent retailers from 2000 through 2003, examined in groupings by efficiency level. Note that the ENERGY STAR threshold is 111% above the federal standard. As shown in Figure 3-3, nearly all clothes washers sold by independent retailers in the RMST panel exceeded the federal standard. Sales of the high efficiency and ENERGY STAR units have exhibited growth, with the percentage of units sold that meet or exceed the ENERGY STAR specification gradually increasing over time. Note that the fourth and fifth efficiency groupings shown in Figure 3-3 below represent sales of clothes washers that met or exceeded the federal standard (i.e., sales of models whose efficiency levels were 111% or greater above the federal standard); thus, the increase in the sum of the shares in these two efficiency groupings over time indicates an increase in the total percentage sold of units that met or exceeded the ENERGY STAR specification.

Figure 3-4 illustrates the average EF of clothes washers sold by independent appliance retailers throughout California from 2000 through 2003. As shown, the average EF has fluctuated between 1.93 and 2.67. The average EF during 2003 was significantly higher than in previous years.

**Figure 3-3: Percent of Independent Clothes Washer Sales by Efficiency Level**



**Figure 3-4: Average Energy Factor for Clothes Washers Sold By Independent Appliance Retailers**



It is important to reiterate that the estimates of average EF presented above were developed solely from sales data obtained from independent appliance retailers. National chain data is not included in the analyses since data received from D&R does not contain the EF of the units sold.

# 4

## Dishwashers

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### 4.1 Overview

This section discusses total dishwasher unit sales, efficiency standards, market shares of ENERGY STAR qualified units and analysis of ENERGY STAR sales by market channel.

### 4.2 Total Unit Sales

Table 4-1 presents estimates of annual unit sales of dishwashers used in the development of market shares in this report. The Association of Home Appliance Manufacturers (AHAM) was the main source of information for these estimates.

**Table 4-1: Estimate of Total Dishwashers Units Sales in California**

| Measure     | 1998    | 1999    | 2000    | 2001    | 2002    | 2003    |
|-------------|---------|---------|---------|---------|---------|---------|
| Dishwashers | 509,000 | 566,800 | 579,100 | 595,800 | 660,300 | 716,200 |

Based on AHAM Shipment Data.

### 4.3 Dishwasher Energy Efficiency Standards

Dishwasher efficiency ratings are based on estimated annual energy use (kWh) under “typical conditions” and an average of 264 loads, or cycles, per year. This EF is computed as follows:

$$EF = \frac{\text{Average Cycles per Year}}{\text{Annual Energy Usage (kWh)}}$$

**Federal Energy Use Standard.** On June 17, 2002, the DOE decreased the number of cycles used to calculate a dishwasher’s EF from 322 cycles to 264 cycles. In addition, with another rulemaking on August 29, 2003, the number of cycles used for the dishwasher EF equation was further decreased to 215 cycles. The 215 cycle level took effect on February 24, 2004. As a result, without any alterations to the models available, the general EFs of dishwashers would fall due to the decrease in cycles, even though the energy efficiency standards have not changed. Therefore, in order to maintain the same efficiency relationship

to the federal energy standard, dishwashers would be required to become increasingly efficient.

Finally, effective September 29, 2003 a new test procedure was passed for soil sensing dishwashers, since manufacturers reported an inability to adequately test these models using existing test procedures.<sup>11</sup> The Department of Energy (DOE) announced that the EF for soil sensing dishwashers must be calculated based on a weighted average of the results from three separate tests at three different soil levels (heavy, medium, and light). The results of each of the tests would be weighted according to the average frequency in which consumers wash heavy, medium, and light loads. The test procedure for non-soil sensing dishwashers would continue to require only one test using a load of clean dishes. Dishwasher manufacturers were required to self-test their equipment according to the DOE test procedures described above by February 25, 2004.

Manufacturers or private labelers were also required to include the measurement of standby power consumption in the estimated annual operating cost and estimated annual energy use calculations for all dishwasher models. The EF rating, however, was not required to include standby power consumption amounts.

**ENERGY STAR Standard.** The ENERGY STAR qualification for dishwashers changed on January 1, 2001. The new qualification was based on the SEHA program from the CEE.<sup>12</sup> As of January 1, 2001, ENERGY STAR qualified dishwashers must exceed the minimum federal standard by at least 25%. Previously, ENERGY STAR qualified dishwashers were required to exceed the minimum federal standard by 13%.

**California Standard.** In January 2002, the CEC amended its appliance efficiency regulations to reflect the increase in the federal energy use standards for several appliances. However, as with the federal standard, the actual dishwasher standard EF for California was not modified during those proceedings.

Table 4-2 presents the current energy efficiency standards and ENERGY STAR specification for dishwashers. As shown, all standard-sized dishwashers must possess an EF of at least 0.46.<sup>13</sup>

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<sup>11</sup> [http://www.eere.energy.gov/buildings/appliance\\_standards/residential/pdfs/dishwasher\\_test\\_procedure.pdf](http://www.eere.energy.gov/buildings/appliance_standards/residential/pdfs/dishwasher_test_procedure.pdf)

<sup>12</sup> Many parties are hoping that new federal dishwasher efficiency standards will be passed imminently. If this comes to fruition, it would likely take effect on January 1, 2005. Consortium for Energy Efficiency. Super Efficient Home Appliance Initiative: Dishwashers. [www.ceeformt.org/resid/seha/dishw/dishw-main.php3](http://www.ceeformt.org/resid/seha/dishw/dishw-main.php3)

<sup>13</sup> Compact dishwashers are not eligible for an ENERGY STAR specification. Compact dishwashers are defined as those with a capacity less than eight place settings and six serving pieces.

**Table 4-2: Comparison of Dishwasher Energy Efficiency Standards**

|                             | Energy Factor |
|-----------------------------|---------------|
| <b>NAECA* Standard</b>      | 0.46          |
| <b>ENERGY STAR Standard</b> | 0.58          |
| <b>California Standards</b> | 0.46          |

\* National Appliance Energy Consumption Act

#### 4.4 Market Share of ENERGY STAR Qualified Dishwashers

Figure 4-1 and Table 4-3 present the percentage of ENERGY STAR qualified dishwashers sold in California during the first quarter of 1998 through the fourth quarter of 2003.<sup>14</sup> As shown, shares of ENERGY STAR dishwasher sales have increased significantly since 1998. This increase was driven largely by the increasing shares of ENERGY STAR qualified dishwashers sold by independent appliance retailers in California.

It is interesting to note that while the EF calculation changed in mid-2002, the percentage of ENERGY STAR qualified units continued to increase throughout the year. One reason for this result is that dishwasher manufacturers adjusted their models available prior to the January 1, 2001 change to the ENERGY STAR specification.<sup>15, 16</sup> These actions would most likely be attributable to the desire of manufacturers to prevent a drop in models available that met the specifications for the ENERGY STAR program, since ENERGY STAR usually forms the basis for incentive programs.

Table 4-4 reports the percent of ENERGY STAR compliant dishwashers sold in each utility service area annually and by quarter. As shown in Table 4-4, PG&E's service territory exhibited the highest percentage of ENERGY STAR dishwasher sales in 2003, at 86.1%, followed closely by the SCE service territory, at 83.4%. The "Other" and SDG&E service territories reported the lowest percentages, at 59.98% and 58.02%, respectively.

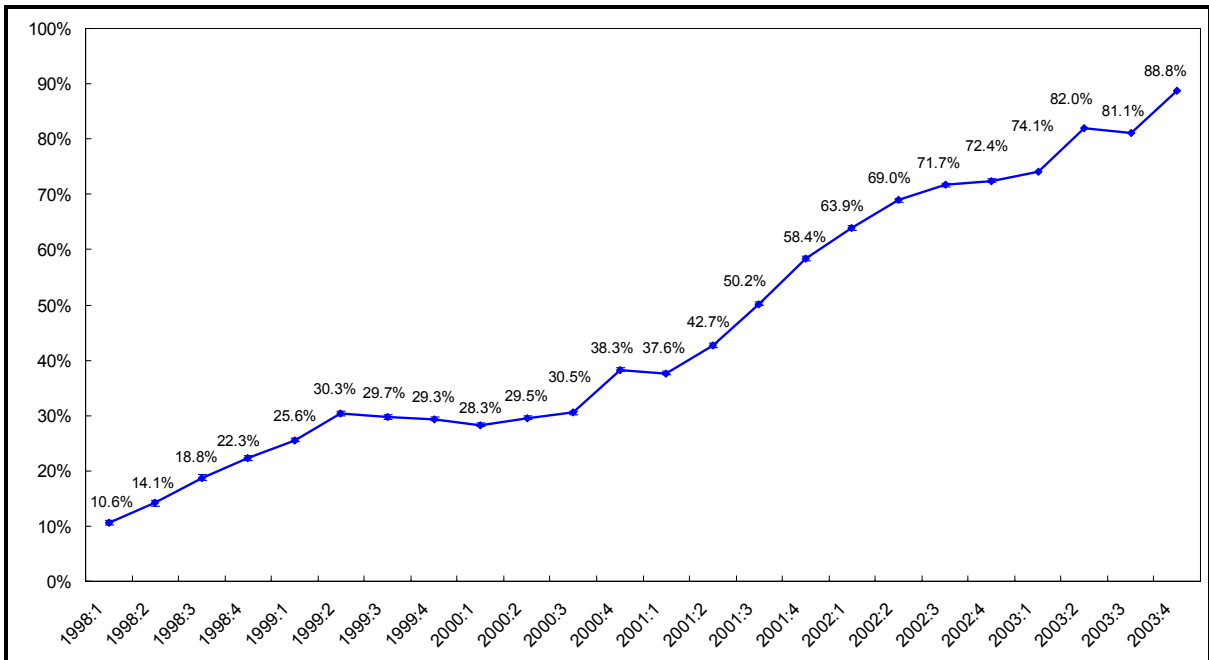
<sup>14</sup> In Figure 4-1, Table 4-3, and Table 4-4, data from 1998 reflect national chain D&R data only. Because of this and the adjustments made to better estimate 1998 results, standard errors are not listed.

<sup>15</sup> This possibility is not reflected in the previous graphs in this Section which used data from the CEC database, most likely because that database is not as comprehensive as the tracking data collected and developed for this study.

<sup>16</sup> The adjustment required to improve dishwasher efficiency does not require radical modification of the unit in question. The CEC lists a few changes manufacturers can make in order to increase the efficiency of their dishwashers. <http://www.cee1.org/resid/seha/dishw/dishw-main.php3>



**Figure 4-1: Dishwasher Sales, Percent of ENERGY STAR Qualified Units**



Error bands for the 90% confidence interval.

**Table 4-3: Dishwasher Sales, Percent of ENERGY STAR Qualified Units (Statewide)**

| Year | Percent of ENERGY STAR Qualified Dishwashers |                                  |                                  |                                  |                                  |
|------|--|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
|      | Annual                                       | Q1                               | Q2                               | Q3                               | Q4                               |
| 1998 | 16.91%<br>(-)<br>n = 66,161                  | 10.69%<br>(-)<br>n = 15,478      | 14.23%<br>(-)<br>n = 15,012      | 18.91%<br>(-)<br>n = 16,775      | 22.43%<br>(-)<br>n = 18,896      |
| 1999 | 28.76%<br>(0.001)<br>n = 194,979             | 25.58%<br>(0.0019)<br>n = 47,633 | 30.34%<br>(0.0021)<br>n = 47,098 | 29.74%<br>(0.0021)<br>n = 46,689 | 29.35%<br>(0.002)<br>n = 53,559  |
| 2000 | 31.64%<br>(.0010)<br>n=214,069               | 28.29%<br>(.0018)<br>n=60,727    | 29.54%<br>(.0019)<br>n=56,656    | 30.48%<br>(.0022)<br>n=44,899    | 38.28%<br>(.0021)<br>n=51,787    |
| 2001 | 47.71%<br>(0.0012)<br>n = 184,187            | 37.65%<br>(0.0023)<br>n = 44,730 | 42.67%<br>(0.0024)<br>n = 42,940 | 50.19%<br>(0.0024)<br>n = 44,784 | 58.38%<br>(0.0022)<br>n = 51,733 |
| 2002 | 69.19%<br>(0.0011)<br>n = 192,032            | 63.92%<br>(0.0022)<br>n = 47,405 | 68.95%<br>(0.0021)<br>n = 47,971 | 71.68%<br>(0.0021)<br>n = 45,298 | 72.43%<br>(0.0020)<br>n = 51,358 |
| 2003 | 82.06%<br>(0.0009)<br>n = 197,813            | 74.09%<br>(0.0020)<br>n = 48,553 | 81.95%<br>(0.0017)<br>n = 49,761 | 81.06%<br>(0.0018)<br>n = 46,281 | 88.80%<br>(0.0014)<br>n = 53,218 |

Standard errors in parentheses.

**Table 4-4: Dishwasher Sales, Percent of ENERGY STAR Qualified Units by Utility Service Area**

| Utility | Year | Percent of ENERGY STAR Qualified Dishwashers |                                |                                |                                |                                |
|---------|------|--|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
|         |      | Annual                                       | Q1                             | Q2                             | Q3                             | Q4                             |
| PG&E    | 1998 | 12.00%<br>(-)<br>n=24,900                    | 7.62%<br>(-)<br>n=5,671        | 10.76%<br>(-)<br>n=5,626       | 13.54%<br>(-)<br>n=6,522       | 15.10%<br>(-)<br>n=7,081       |
|         | 1999 | 16.19%<br>(0.0014)<br>n=69,128               | 11.57%<br>(0.0024)<br>n=17,005 | 13.26%<br>(0.0026)<br>n=16,425 | 18.09%<br>(0.003)<br>n=16,172  | 21.11%<br>(0.0029)<br>n=19,526 |
|         | 2000 | 30.73%<br>(0.0015)<br>n=94,925               | 28.26%<br>(0.0028)<br>n=25,748 | 28.88%<br>(0.0029)<br>n=24,730 | 31.56%<br>(0.0032)<br>n=20,976 | 34.35%<br>(0.0031)<br>n=23,471 |
|         | 2001 | 53.07%<br>(0.0017)<br>n=91,396               | 42.98%<br>(0.0033)<br>n=22,532 | 50.82%<br>(0.0034)<br>n=21,389 | 57.82%<br>(0.0033)<br>n=22,475 | 60.17%<br>(0.0031)<br>n=25,000 |
|         | 2002 | 73.68%<br>(0.0015)<br>n=85,869               | 67.90%<br>(0.0032)<br>n=21,314 | 73.80%<br>(0.0030)<br>n=21,844 | 76.94%<br>(0.0029)<br>n=20,540 | 75.64%<br>(0.0029)<br>n=22,171 |
|         | 2003 | 86.13%<br>(0.0012)<br>n=82,079               | 85.09%<br>(0.0024)<br>n=21,318 | 85.97%<br>(0.0024)<br>n=21,398 | 82.73%<br>(0.0028)<br>n=18,310 | 90.92%<br>(0.0020)<br>n=21,053 |
| SCE     | 1998 | 20.44%<br>(-)<br>n=20,197                    | 12.01%<br>(-)<br>n=4,893       | 15.40%<br>(-)<br>n=4,596       | 22.14%<br>(-)<br>n=4,940       | 30.15%<br>(-)<br>n=5,768       |
|         | 1999 | 29.6%<br>(0.0017)<br>n=68,633                | 26.23%<br>(0.0034)<br>n=16,560 | 32.47%<br>(0.0036)<br>n=17,027 | 30.78%<br>(0.0036)<br>n=16,882 | 28.9%<br>(0.0034)<br>n=18,164  |
|         | 2000 | 32.16%<br>(0.0018)<br>n=65,649               | 28.45%<br>(0.0032)<br>n=19,451 | 30.38%<br>(0.0035)<br>n=17,358 | 29.95%<br>(0.0040)<br>n=13,271 | 39.90%<br>(0.0039)<br>n=15,669 |
|         | 2001 | 47.52%<br>(0.0022)<br>n=51,430               | 34.55%<br>(0.0043)<br>n=12,227 | 37.34%<br>(0.0044)<br>n=11,849 | 49.09%<br>(0.0045)<br>n=12,273 | 63.24%<br>(0.0039)<br>n=15,081 |
|         | 2002 | 72.57%<br>(0.0018)<br>n=60,392               | 67.10%<br>(0.0038)<br>n=14,981 | 71.47%<br>(0.0037)<br>n=14,823 | 74.05%<br>(0.0037)<br>n=13,954 | 78.64%<br>(0.0032)<br>n=16,634 |
|         | 2003 | 83.41%<br>(0.0014)<br>n=66,365               | 47.84%<br>(0.0040)<br>n=15,417 | 83.59%<br>(0.0029)<br>n=16,371 | 84.93%<br>(0.0028)<br>n=16,233 | 89.77%<br>(0.0022)<br>n=18,344 |
| SDG&E   | 1998 | 15.41%<br>(-)<br>n=6,510                     | 12.02%<br>(-)<br>n=1,466       | 14.29%<br>(-)<br>n=1,487       | 17.64%<br>(-)<br>n=1,724       | 17.30%<br>(-)<br>n=1,833       |
|         | 1999 | 30.04%<br>(0.0032)<br>n=20,564               | 29.29%<br>(0.0064)<br>n=4,995  | 31.18%<br>(0.0066)<br>n=4,868  | 29.15%<br>(0.0065)<br>n=4,872  | 30.55%<br>(0.006)<br>n=5,829   |
|         | 2000 | 36.28%<br>(0.0035)<br>n=18,996               | 30.74%<br>(0.0061)<br>n=5,674  | 32.54%<br>(0.0066)<br>n=5,070  | 33.42%<br>(0.0076)<br>n=3,831  | 47.79%<br>(0.0075)<br>n=4,421  |
|         | 2001 | 25.55%<br>(0.0036)<br>n=14,803               | 20.72%<br>(0.0068)<br>n=3,596  | 24.33%<br>(0.0073)<br>n=3,485  | 25.14%<br>(0.0073)<br>n=3,493  | 31.02%<br>(0.0071)<br>n=4,229  |
|         | 2002 | 31.11%<br>(0.0040)<br>n=13,357               | 27.40%<br>(0.0077)<br>n=3,318  | 31.71%<br>(0.0081)<br>n=3,330  | 34.85%<br>(0.0084)<br>n=3,185  | 30.65%<br>(0.0078)<br>n=3,524  |
|         | 2003 | 58.02%<br>(0.0043)<br>n=13,358               | 43.79%<br>(0.0085)<br>n=3,396  | 51.21%<br>(0.0089)<br>n=3,148  | 52.87%<br>(0.0089)<br>n=3,115  | 81.21%<br>(0.0064)<br>n=3,699  |
| Other*  | 1998 | 12.92%<br>(-)<br>n=14,554                    | 8.18%<br>(-)<br>n=3,448        | 11.77%<br>(-)<br>n=3,303       | 14.76%<br>(-)<br>n=3,589       | 16.15%<br>(-)<br>n=4,214       |
|         | 1999 | 27.68%<br>(0.0023)<br>n=36,654               | 24.10%<br>(0.0045)<br>n=9,073  | 27.92%<br>(0.0048)<br>n=8,778  | 28.28%<br>(0.0048)<br>n=8,763  | 29.35%<br>(0.0045)<br>n=10,040 |
|         | 2000 | 29.72%<br>(0.0025)<br>n=34,399               | 26.47%<br>(0.0044)<br>n=9,854  | 27.41%<br>(0.0046)<br>n=9,898  | 27.18%<br>(0.0054)<br>n=8,821  | 37.80%<br>(0.0053)<br>n=8,226  |
|         | 2001 | 39.22%<br>(0.0030)<br>n=26,558               | 34.48%<br>(0.0060)<br>n=6,375  | 38.91%<br>(0.0062)<br>n=6,217  | 38.11%<br>(0.0060)<br>n=6,543  | 45.00%<br>(0.0058)<br>n=7,423  |
|         | 2002 | 33.09%<br>(0.0026)<br>n=32,414               | 29.47%<br>(0.0052)<br>n=7,792  | 34.04%<br>(0.0053)<br>n=7,974  | 35.62%<br>(0.0055)<br>n=7,619  | 33.24%<br>(0.0050)<br>n=9,029  |
|         | 2003 | 59.98%<br>(0.0026)<br>n=36,011               | 50.96%<br>(0.0054)<br>n=8,422  | 52.78%<br>(0.0053)<br>n=8,844  | 57.31%<br>(0.0053)<br>n=8,623  | 76.05%<br>(0.0042)<br>n=10,122 |

\* "Other" includes areas served by municipal utilities such as LADWP, LMUD, PP&L, SMUD, and others.

## **4.5 Analysis by Market Channel**

### ***Comparison of Sales Data from National Chains and Independent Retailers***

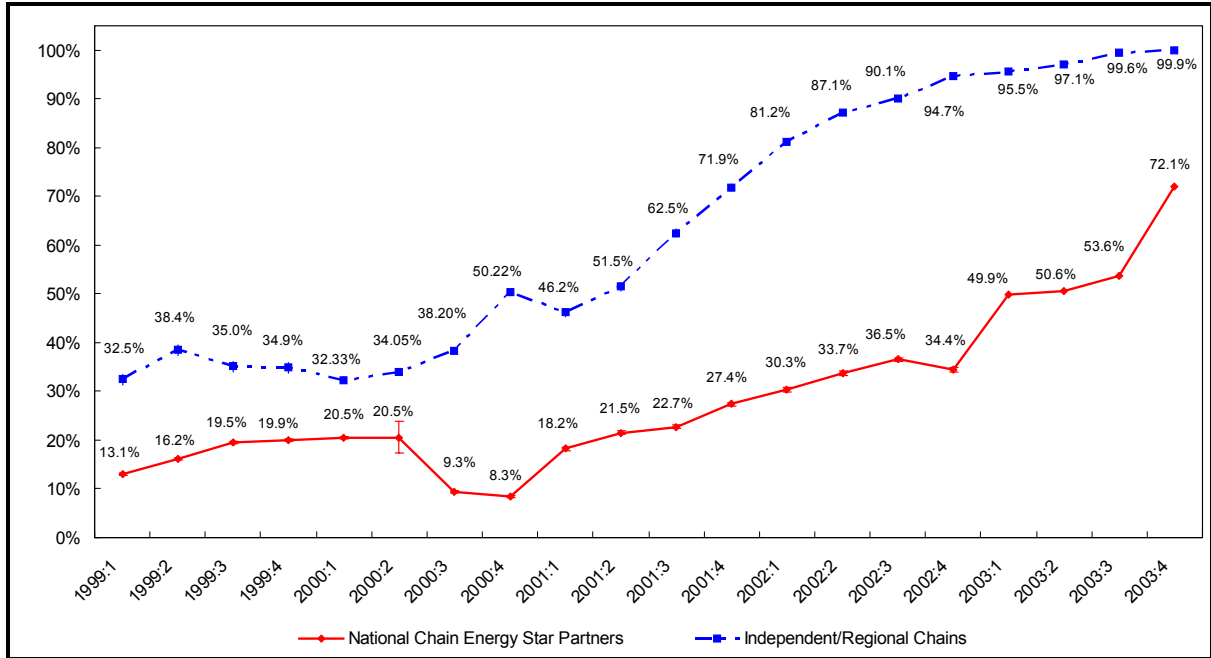
Figure 4-2 and Table 4-5 compare the shares of ENERGY STAR qualified dishwashers sold by national chains and independently owned stores and regional chains. As shown, the share sold by the national chains continues to be considerably lower than the share sold by the independent appliance retailers. However, over the past five years, both national chains and independent appliance retailers have experienced significant growth in the share of ENERGY STAR dishwashers sold. With the exception of the decrease in the third and fourth quarters of 2000, the share sold by national chains grew from 13.1% in the first quarter of 1999 to 72.1% in the last quarter of 2003.<sup>17</sup>

Even more notable is the increase among independent appliance retailers from 32.5% at the beginning of 1999 to 99.9% in the last quarter of 2003. In other words, almost all of the dishwashers sold by independent appliance retailers throughout California met the ENERGY STAR criteria in the third quarter of 2003. This growth most likely reflects a change in the mix of available models, with a larger proportion qualifying for ENERGY STAR, and not necessarily a change in consumer preferences. In particular, manufacturers have been producing a greater number of more efficient models to meet upcoming expected changes in the testing procedures (i.e. changing from 322 cycles to 264 cycles and subsequently to 215 cycles). For example, manufacturers planning to change model efficiency from 322 to 264 cycles to meet the new testing requirement would need to manufacture units that operate at an annual 125 kWh less than previously required by the federal standard. Similarly, manufacturers planning to change model efficiency from 322 to 215 cycles to meet the new testing requirement would need to manufacture units that operate at an annual 232 kWh less than previously required. As these more efficient models became available before they were actually required, their EF, calculated at the higher number of cycles, often met or exceeded the ENERGY STAR qualification. Thus, the proportion of available models that met ENERGY STAR qualifications grew significantly, nearly reaching 100% among independent retailers by the end of 2003.

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<sup>17</sup> The decrease shown during the third and fourth quarters of 2000 is due to a change in participating retailers on a national level.

**Figure 4-2: Dishwasher Sales, Percent of ENERGY STAR Qualified Units by Retailer Type**



Error bands for the 90% confidence interval.

**Table 4-5: Dishwasher Sales, Percent of ENERGY STAR Qualified Units by Market Channel**

| Year/Quarter | Market Channel                      |                                  |
|--------------|-------------------------------------|----------------------------------|
|              | National Chain ENERGY STAR Partners | Independent and Regional Chains  |
| 1999:1       | 13.06%<br>(0.0014)<br>n = 69,128    | 32.5%<br>(0.0066)<br>n = 5,067   |
| 1999:2       | 16.17%<br>(0.0018)<br>n = 42,227    | 38.42%<br>(0.0069)<br>n = 4,871  |
| 1999:3       | 19.48%<br>(0.0019)<br>n = 41,425    | 35.05%<br>(0.0066)<br>n = 5,264  |
| 1999:4       | 19.94%<br>(0.0018)<br>n = 48,184    | 34.88%<br>(0.0065)<br>n = 5,375  |
| 2000:1       | 20.45%<br>(0.0019)<br>n = 45,309    | 32.33%<br>(0.0038)<br>n = 15,418 |
| 2000:2       | 20.50%<br>(0.0020)<br>n = 41,854    | 34.05%<br>(0.0039)<br>n = 14,802 |
| 2000:3       | 9.34%<br>(0.0017)<br>n = 30,180     | 38.20%<br>(0.0040)<br>n = 14,719 |
| 2000:4       | 8.34%<br>(0.0015)<br>n = 35,928     | 50.22%<br>(0.0040)<br>n = 15,859 |
| 2001:1       | 18.20%<br>(0.0021)<br>n = 35,045    | 46.20%<br>(0.0051)<br>n = 9,685  |
| 2001:2       | 24.53%<br>(0.0022)<br>n = 33,560    | 51.46%<br>(0.0052)<br>n = 9,380  |
| 2001:3       | 22.66%<br>(0.0022)<br>n = 35,237    | 62.48%<br>(0.0050)<br>n = 9,547  |
| 2001:4       | 27.43%<br>(0.0022)<br>n = 41,079    | 71.86%<br>(0.0044)<br>n = 10,654 |
| 2002:1       | 30.35%<br>(0.0027)<br>n = 41,160    | 81.18%<br>(0.0049)<br>n = 6,245  |
| 2002:2       | 33.72%<br>(0.0023)<br>n = 40,640    | 87.08%<br>(0.0039)<br>n = 7,331  |
| 2002:3       | 36.50%<br>(0.0025)<br>n = 38,225    | 90.08%<br>(0.0036)<br>n = 7,073  |
| 2002:4       | 34.43%<br>(0.0023)<br>n = 44,304    | 94.73%<br>(0.0027)<br>n = 7,054  |
| 2003:1       | 49.87%<br>(0.0024)<br>n = 42,754    | 95.52%<br>(0.0027)<br>n = 5,799  |
| 2003:2       | 50.57%<br>(0.0024)<br>n = 43,700    | 97.07%<br>(0.0022)<br>n = 6,061  |
| 2003:3       | 53.62%<br>(0.0024)<br>n = 43,605    | 99.58%<br>(0.0013)<br>n = 2,676  |
| 2003:4       | 72.06%<br>(0.0020)<br>n = 50,186    | 99.89%<br>(0.0006)<br>n = 3,032  |

Standard errors in parentheses.

It is important to note that this discussion refers to appliances that meet ENERGY STAR specifications based on their efficiency level, and it does not necessarily refer to appliances that carry the ENERGY STAR label.

### ***Energy Factor Analysis***

Figure 4-3 illustrates the high percentage of ENERGY STAR sales by independent appliance retailers in California. For example, the majority of sales in 2000 were units with efficiencies between 13% to 26% above the federal standard, thus qualifying for ENERGY STAR. In 2001, when the ENERGY STAR specification changed, roughly 30% of units sold qualified for ENERGY STAR. In 2002, the number of cycles used to calculate the EF rating was reduced and the percentage of ENERGY STAR qualified units sold by independent retailers increased further. In 2003, the percentage of ENERGY STAR qualified units sold by independent retailers rose even higher, with nearly all units sold by independents meeting the ENERGY STAR specification.

The detailed data shared by independent retailers from 2000 through 2003 allowed the data to be analyzed in groupings of efficiency levels. Note that the ENERGY STAR threshold was 13% above the federal standard in 2000 and became 25% above the federal standard in 2001. In addition, when the DOE decreased the number of dishwasher cycles used in the calculation for EF for all units manufactured from July 1, 2002 onward, this change resulted in a lower EF rating of all dishwashers than previously calculated. This allowed the DOE to enforce higher efficiency levels without modifying the federal standard EF rating for dishwashers.

**Figure 4-3: Percent of Independent Dishwasher Sales by Efficiency Level**

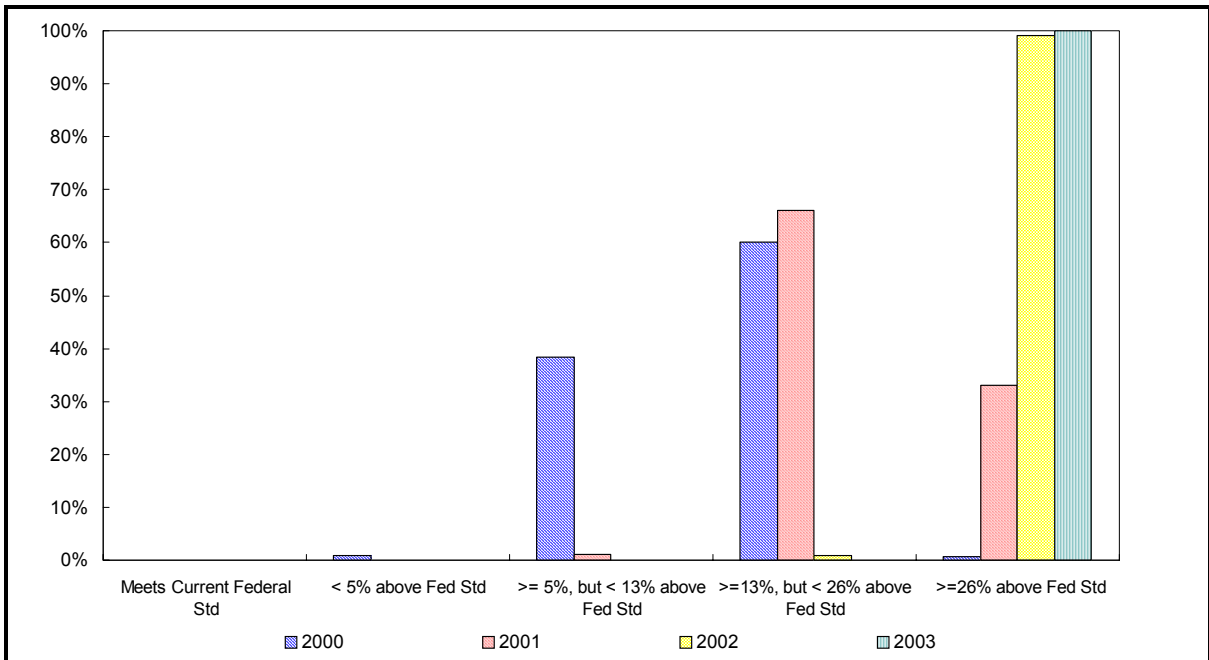


Figure 4-4 illustrates the average EF of dishwashers sold by independent appliance retailers throughout California from 1999 through 2003. As shown, after remaining relatively stable during 1999 and 2000, the average EF rose during the fourth quarter of 2000 and continued to rise through the second quarter of 2002.

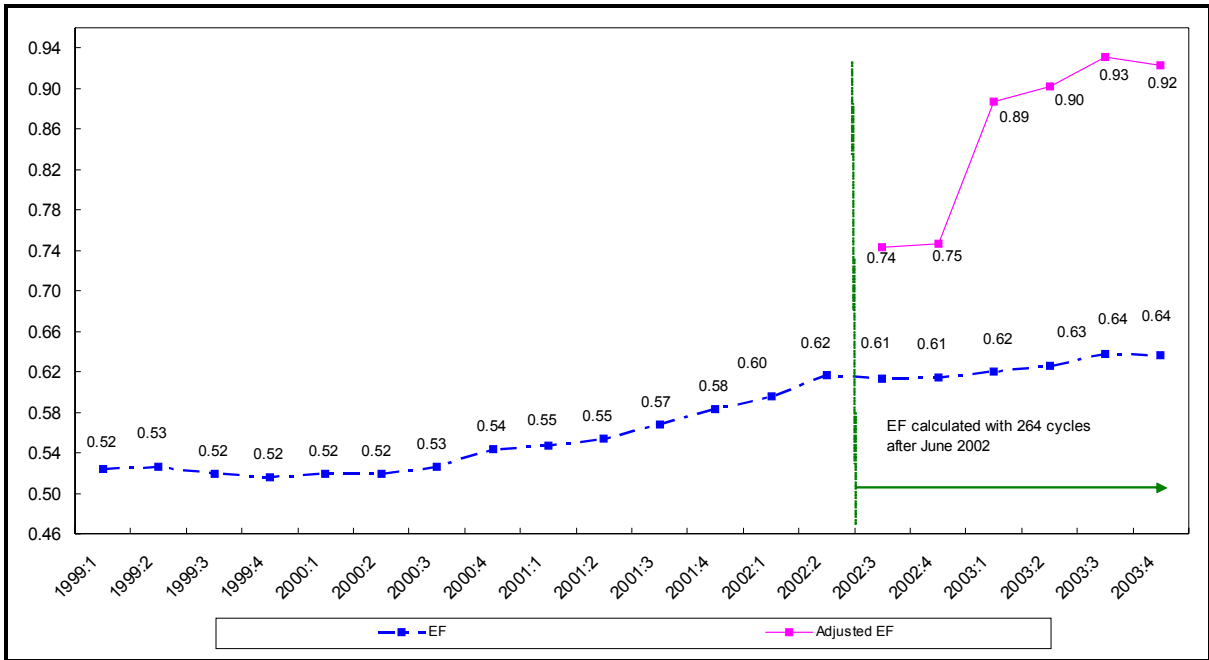
As explained previously, the steady and significant increase in the share of ENERGY STAR qualified dishwashers sold by independent appliance retailers in California is most likely due to dishwasher manufacturers modifying their products to adapt to upcoming changes in the number of cycles used to calculate EF. This may also explain the dramatic growth in average EF throughout 2001 and the first two quarters of 2002. The reduction in the number of cycles led manufacturers to create dishwashers with greater efficiency in order to continue to comply with the federal standard and/or to maintain ENERGY STAR qualification.

Note that the EF for all dishwashers sold from July 1, 2002 onward, which were not directly matched to information from the ENERGY STAR program but where the project team calculated the EF, were calculated using the 264 cycles per year figure from the updated regulation by the DOE. For comparison, the second line in Figure 4-4, labeled “Adjusted EF,” represents the EF as calculated with 322 cycles per year.

As shown in Figure 4-4, the average EF of dishwashers sold would have risen sharply between the fourth quarter of 2002 and the first quarter of 2003 absent the change in the number of cycles used to compute dishwasher EF. However, with the cycle changes, the average EF of dishwashers sold by independents actually fell after the second half of 2002

before rebounding in 2003. Furthermore, regardless of the changes made to the number of cycles used to calculate EF, the majority of models offered to consumers by independent appliance retailers are now ENERGY STAR qualified, and the average EF of units sold in 2003 exceeded the ENERGY STAR qualification.

**Figure 4-4: Average Energy Factor for Dishwashers Sold By Independent Appliance Retailers**





# 5

## Refrigerators

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### 5.1 Overview

This section discusses total refrigerator unit sales, efficiency standards, market share of ENERGY STAR qualified units, and analysis of ENERGY STAR sales by market channel.

### 5.2 Total Unit Sales

Table 5-1 presents estimates of annual unit sales of refrigerators used in the development of market shares in this report. The Association of Home Appliance Manufacturers (AHAM) was the source of information for these estimates.

**Table 5-1: Estimate of Total Refrigerator Units Sales in California**

| Measure       | 1998    | 1999    | 2000      | 2001      | 2002      | 2003      |
|---------------|---------|---------|-----------|-----------|-----------|-----------|
| Refrigerators | 949,400 | 975,700 | 1,025,300 | 1,150,600 | 1,199,100 | 1,234,600 |

Source: AHAM

### 5.3 Refrigerator Energy Efficiency Standards

Refrigerator energy use ratings are expressed in terms of expected annual energy use (kWh) under “typical conditions.” Federal energy use standards vary by refrigerator configuration and are a function of the unit’s adjusted volume (AV).<sup>18</sup>

The EF for refrigerators is calculated as follows.

$$EF = \frac{\text{Adjusted Volume}}{\text{Annual Energy Usage (kWh)} / 365}$$

where the *Adjusted Volume* is the fresh volume of the unit plus 1.63 times the unit’s freezer volume.

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<sup>18</sup> Adjusted volume takes into account the differing temperatures between the refrigerator and freezer compartments with the following calculation: fresh volume plus (freezer volume times 1.63). The result is called the total adjusted volume and is used in the energy factor calculation.

**Federal Energy Use Standard.** Federal energy use standards for refrigerators changed on July 1, 2001.<sup>19</sup> The required energy use reductions from the former standard to the 2001 standard varied by configuration, ranging between 27% and 32%. Six months prior to the standards change, AHAM's Directory of Certified Refrigerators and Freezers contained 1,217 refrigerator/freezer models with automatic defrost, though only 25 of these already met the new standard. During the first half of 2001, manufacturers were preparing for the new energy use standards, which decreased refrigerators energy consumption an average of 25%.

**ENERGY STAR Standard.** Additionally, the ENERGY STAR standard, which took effect January 1, 2001, required refrigerators to consume 10% less energy than the July 1, 2001 federal standard. AHAM's Directory of Certified Refrigerators and Freezers for July 2001 showed that 515 of the 1094 refrigerator/freezer models with automatic defrost complied with the new federal standard. The CEC's appliance efficiency regulations were amended in January 2002 to reflect the increase in the federal energy use standards, though the CEC did not surpass the federal requirements for appliance efficiency standards.

In 2001, only full-size refrigerator-freezers were eligible for ENERGY STAR. Full-size automatic-defrost refrigerator-freezers were required to be 10% more efficient than the federal standard in order to qualify for ENERGY STAR.

However, on January 1, 2003, the ENERGY STAR criteria for refrigerators was expanded to include all sizes and configurations of refrigerators and freezers, qualifying previously ineligible products in the following categories:

- Manual defrost refrigerators,
- Partial automatic defrost refrigerators, and
- Single door refrigerators.<sup>20</sup>

All refrigerators 7.75 cubic feet or greater in volume were required to exceed the minimum federal standard by at least 10% to qualify for ENERGY STAR.

It should be noted, however, that expansion of the ENERGY STAR criteria on January 1, 2003 to include previously ineligible categories of refrigerators did not impact the analysis method. Since the current analysis addresses products that would have qualified for the ENERGY STAR label rather than products that actually bear the ENERGY STAR label or

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<sup>19</sup> The 2001 federal standard for refrigerators can be found in the following: Energy Conservation Program for Consumer Products: Energy Conservation Standards for Refrigerators, Refrigerator-Freezers and Freezers. *Federal Register*. Vol. 62, No. 81. April 28, 1997.

<sup>20</sup> On January 1, 2003, the ENERGY STAR criteria was also expanded to include freezers and compact refrigerators and freezers. However, these product categories are outside of the scope of work of the study; thus, these changes will not be addressed by this report.

appear on ENERGY STAR lists, these products have been tracked on an ongoing basis and have been analyzed under the criterion used for standard full-size automatic-defrost refrigerator-freezers to qualify for ENERGY STAR (i.e., 10% above the federal standard).

Additionally, on January 1, 2004, the ENERGY STAR criteria for full-size refrigerators was modified to require all full-sized models to exceed the minimum federal standard by at least 15% to qualify for the ENERGY STAR label. The ENERGY STAR criteria for full-size freezers and compact refrigerators and freezers did not change at that time. As discussed previously, the impact of these changes will not be analyzed in this report, since the analysis contained within this report examines 1998-2003 sales data and efficiency trends.<sup>21</sup>

Table 5-2 summarizes the federal, state, and ENERGY STAR standards for refrigerators through 2004.

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<sup>21</sup> Through 2003, the energy reductions required for a refrigerator to qualify for the Super Efficient Home Appliance (SEHA) initiative by the Consortium for Energy Efficiency (CEE) were as follows: refrigerator models 15, 20, 25 and 30 percent more efficient than the federal standard (NAECA) comply with the SEHA performance levels at Tiers 1, 2, 3 and 4, respectively.

**Table 5-2: Refrigerator Energy Use Standards**

|  | Federal Standard                  |                | ENERGY STAR Criteria                           |  |  |  |
|--|-----------------------------------|----------------|--|--|--|--|
|  | January 1, 1993                   | July 1, 2001   | January 1, 1997                                | January 1, 2001                                | January 1, 2003                                | January 1, 2004                                |
| Refrigerators and refrigerator-freezers, manual defrost  | 13.5*AV+299.0                     | 8.82*AV+248.4  | N/A  | N/A  | 10% less energy than the 2001 federal standard | 15% less energy than the 2001 federal standard |
| Refrigerator-freezers, partial automatic defrost   | 10.4*AV+398.0                     | 8.82*AV+248.4  |  |  |  |  |
| Refrigerator-freezers, automatic defrost, top mount without TTD  | 16.0*AV+355.0                     | 9.80*AV+276.0  | 20% less energy than the 1993 federal standard | 10% less energy than the 2001 federal standard |  |  |
| Refrigerator-freezers, automatic defrost, side mount without TTD   | 11.8*AV+501.0                     | 4.91*AV+507.5  |  |  |  |  |
| Refrigerator-freezers, automatic defrost, bottom mount without TTD   | 16.5*AV+367.0                     | 4.60*AV+459.0  |  |  |  |  |
| Refrigerator-freezers, automatic defrost, top mount with TTD   | 17.6*AV+391.0                     | 10.20*AV+356.0 |  |  |  |  |
| Refrigerator-freezers, automatic defrost, side mount with TTD  | 16.3*AV+527.0                     | 10.10*AV+406.0 |  |  |  |  |
| Upright freezers, manual defrost   | 10.3*AV+264.0                     | 7.55*AV+258.3  |  |  | N/A  | N/A  |
| Upright freezers, automatic defrost  | 14.9*AV+391.0                     | 12.43*AV+326.1 |  |  |  |  |
| Chest freezers and all other freezers except compact freezers  | 11.0*AV+160.0                     | 9.88*AV+143.7  |  |  |  |  |
| Compact refrigerators and refrigerator-freezers, manual defrost  | 13.5*AV+299.0                     | 10.70*AV+299.0 | 20% less energy than the 2001 federal standard | 20% less energy than the 2001 federal standard |  |  |
| Compact refrigerator-freezers, partial automatic defrost   | 10.4*AV+398.0                     | 7.00*AV+398.0  |  |  |  |  |
| Compact refrigerator-freezers, automatic defrost with top-mounted freezer and compact all-refrigerators, automatic defrost | 16.0*AV+355.0                     | 12.70*AV+355.0 |  |  |  |  |
| Compact refrigerator-freezers, automatic defrost with side-mounted freezer   | 11.8*AV+501.0                     | 7.60*AV+501.0  |  |  |  |  |
| Compact refrigerator-freezers, automatic defrost with bottom-mounted freezer   | 16.5*AV+367.0                     | 13.10*AV+367.0 |  |  |  |  |
| Compact upright freezers, manual defrost   | 10.3*AV+264.0                     | 9.78*AV+250.8  |  |  |  |  |
| Compact upright freezers, automatic defrost  | 14.9*AV+391.0                     | 11.40*AV+391.0 |  |  |  |  |
| Compact chest freezers   | 11.0*AV+160.0                     | 10.45*AV+152.0 |  |  |  |  |
| <b>CALIFORNIA STANDARDS</b>  | Identical to the federal standard |                |  |  |  |  |

TTD = through-the-door ice dispenser.

For refrigerators, AV = Adjusted Volume = Fresh Volume + (1.63\*Freezer Volume).

Compact refrigerators, refrigerator-freezers, and freezers are products with a total volume of less than 7.75 cubic feet and 36 inches or less in height.

## **5.4 Market Share of ENERGY STAR Qualified Refrigerators**

Figure 5-1 and Table 5-3 present the percentage of ENERGY STAR qualified refrigerators sold in California during the first quarter of 1998 through the fourth quarter of 2003.<sup>22</sup> As shown, the percent of ENERGY STAR refrigerators remained relatively steady throughout 1999 and 2000. The abrupt decrease in market share to almost 0% during the first quarter of 2001 is due to the lack of refrigerators available for purchase that met the new increased ENERGY STAR specification. The ENERGY STAR specification changed on January 1, 2001 and stated that qualified refrigerators had to use 10% less energy than allowed by the July 1, 2001 federal energy use standard. In turn, the growth in share between the first to the second quarter, and then again from the second to the third quarter of 2001, is attributable to manufacturers preparing for the federal standard change. As part of this preparation, ENERGY STAR qualified refrigerator units became available. As this occurred, these units began to regain market share.

In addition to the increasing availability of ENERGY STAR qualified refrigerators, it seems likely that utility incentive programs also affected market share shown in 2001. The peaks seen in the third and fourth quarter of 2001 seem to correlate with utility incentives that encouraged consumers to purchase ENERGY STAR qualified refrigerators. Recent research by the project team indicates that these incentives began July 1, 2001 and ended December 31, 2001. The subsequent decrease in ENERGY STAR share in 2002 would therefore be associated with the lack of utility incentives.

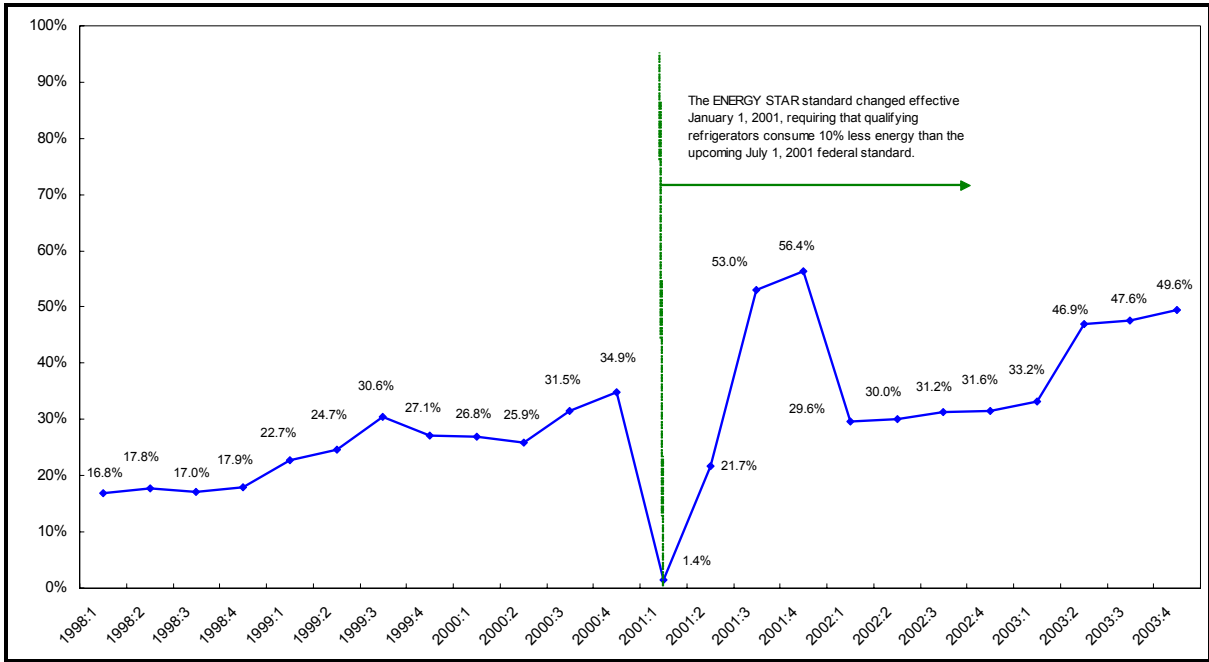
Throughout 2003, the share of ENERGY STAR qualified refrigerators rose. The rise in ENERGY STAR share may be partially attributable to efforts by manufacturers in 2003 to create more efficient models to meet upcoming changes in the ENERGY STAR standards for 2004. The sharp spike in ENERGY STAR share, however, that occurred between the first and second quarters of 2003 is predominantly explained by an increase in ENERGY STAR share among the national chain retailers. Since the project team does not maintain a direct relationship with the national chain retailers, the cause of the sharp spike in national chain retailer share is unknown.

Table 5-4 presents the same information broken down by utility area. As shown in Table 5-4, the PG&E service territory exhibited the highest proportion of ENERGY STAR qualified refrigerator sales, at 46.0%, followed closely by the SCE service territory, at 44.98%. The SDG&E and Other service territories reported the lowest proportion of ENERGY STAR qualified refrigerator sales, at 40.2%.

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<sup>22</sup> In Figure 5-1, Table 5-3, and Table 5-4, data from 1998 represent national chain D&R data only.

**Figure 5-1: Refrigerator Sales, Percent of ENERGY STAR Qualified Units**



Error bands for the 90% confidence interval.

**Table 5-3: Refrigerator Sales, Percent of ENERGY STAR Qualified Units, Statewide**

| Year | Percent of ENERGY STAR Qualified Refrigerators |                                   |                                   |                                   |                                   |
|------|--|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
|      | Annual   | Q1                                | Q2                                | Q3                                | Q4                                |
| 1998 | 17.35%<br>(-)<br>n = 230,171                   | 16.81%<br>(-)<br>n = 46,004       | 17.77%<br>(-)<br>n = 55,309       | 17.03%<br>(-)<br>n = 76,525       | 17.93%<br>(-)<br>n = 52,333       |
| 1999 | 26.49%<br>(0.0006)<br>n = 473,882              | 22.65%<br>(0.0013)<br>n = 110,181 | 24.66%<br>(0.0012)<br>n = 121,250 | 30.55%<br>(0.0013)<br>n = 130,514 | 27.09%<br>(0.0013)<br>n = 111,937 |
| 2000 | 29.78%<br>(0.0007)<br>n = 490,296              | 26.84%<br>(0.0013)<br>n = 115,865 | 25.93%<br>(0.0012)<br>n = 145,173 | 31.49%<br>(0.0013)<br>n = 122,865 | 34.94%<br>(0.0015)<br>n = 106,393 |
| 2001 | 35.39%<br>(0.0007)<br>n = 522,010              | 0.01%<br>(0.0004)<br>n = 104,765  | 21.71%<br>(0.0010)<br>n = 146,412 | 52.99%<br>(0.0013)<br>n = 148,463 | 56.41%<br>(0.0014)<br>n = 122,370 |
| 2002 | 30.61%<br>(0.0006)<br>n = 694,594              | 29.62%<br>(0.0012)<br>n = 155,115 | 29.97%<br>(0.0011)<br>n = 181,401 | 31.24%<br>(0.0010)<br>n = 198,236 | 31.55%<br>(0.0012)<br>n = 159,842 |
| 2003 | 44.44%<br>(0.0007)<br>n = 581,712              | 33.16%<br>(0.011)<br>n = 170,947  | 46.92%<br>(0.0014)<br>n = 128,821 | 47.64%<br>(0.0013)<br>n = 157,519 | 49.58%<br>(0.0014)<br>n = 124,425 |

Standard errors in parentheses.

**Table 5-4: Refrigerator Sales, Percent of ENERGY STAR Qualified Units by Utility Service Area**

| Utility            | Year | Percent of ENERGY STAR Qualified Refrigerators |                                |                                |                                |                                |
|--------------------|------|--|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
|                    |      | Annual   | Q1                             | Q2                             | Q3                             | Q4                             |
| PG&E               | 1998 | 17.37%<br>(-)<br>n=90,493                      | 17.88%<br>(-)<br>n=19,547      | 19.13%<br>(-)<br>n=21,576      | 16.29%<br>(-)<br>n=28,722      | 16.53%<br>(-)<br>n=20,648      |
|                    | 1999 | 28.43%<br>(0.0011)<br>n=157,639                | 23.36%<br>(0.0021)<br>n=38,313 | 24.60%<br>(0.0021)<br>n=40,307 | 31.46%<br>(0.0023)<br>n=41,424 | 34.38%<br>(0.0025)<br>n=37,595 |
|                    | 2000 | 34.97%<br>(0.0011)<br>n=179,113                | 34.30%<br>(0.0023)<br>n=42,475 | 31.14%<br>(0.0020)<br>n=52,914 | 34.57%<br>(0.0023)<br>n=43,030 | 40.57%<br>(0.0024)<br>n=40,694 |
|                    | 2001 | 35.50%<br>(0.0011)<br>n=206,711                | 0.02%<br>(0.0006)<br>n=43,728  | 26.75%<br>(0.0018)<br>n=58,424 | 54.55%<br>(0.0021)<br>n=57,738 | 40.57%<br>(0.0023)<br>n=46,821 |
|                    | 2002 | 37.29%<br>(0.0010)<br>n=252,536                | 35.86%<br>(0.0020)<br>n=57,267 | 37.83%<br>(0.0019)<br>n=66,242 | 38.50%<br>(0.0018)<br>n=70,350 | 36.71%<br>(0.0020)<br>n=58,677 |
|                    | 2003 | 45.98%<br>(0.0011)<br>n=211,498                | 37.69%<br>(0.0019)<br>n=63,250 | 48.98%<br>(0.0023)<br>n=48,387 | 49.91%<br>(0.0021)<br>n=54,846 | 49.31%<br>(0.0024)<br>n=45,015 |
| SCE                | 1998 | 16.17%<br>(-)<br>n=69,987                      | 14.16%<br>(-)<br>n=13,179      | 15.81%<br>(-)<br>n=17,023      | 16.25%<br>(-)<br>n=24,049      | 18.13%<br>(-)<br>n=15,736      |
|                    | 1999 | 25.39%<br>(0.0011)<br>n=168,527                | 21.47%<br>(0.0021)<br>n=37,392 | 23.68%<br>(0.0020)<br>n=43,460 | 30.44%<br>(0.0021)<br>n=48,231 | 24.62%<br>(0.0022)<br>n=39,444 |
|                    | 2000 | 24.59%<br>(0.0011)<br>n=165,926                | 19.99%<br>(0.0020)<br>n=39,486 | 20.44%<br>(0.0018)<br>n=49,416 | 27.98%<br>(0.0022)<br>n=42,985 | 29.14%<br>(0.0024)<br>n=34,039 |
|                    | 2001 | 42.80%<br>(0.0012)<br>n=174,894                | 0.01%<br>(0.0006)<br>n=32,063  | 20.38%<br>(0.0018)<br>n=49,836 | 63.69%<br>(0.0021)<br>n=50,445 | 68.12%<br>(0.0023)<br>n=42,550 |
|                    | 2002 | 26.43%<br>(0.0009)<br>n=231,730                | 25.92%<br>(0.0019)<br>n=51,988 | 24.30%<br>(0.0017)<br>n=60,352 | 26.56%<br>(0.0017)<br>n=67,547 | 29.16%<br>(0.0020)<br>n=51,843 |
|                    | 2003 | 44.98%<br>(0.0011)<br>n=195,784                | 28.74%<br>(0.0019)<br>n=56,672 | 45.48%<br>(0.0024)<br>n=42,524 | 47.06%<br>(0.0021)<br>n=54,812 | 51.50%<br>(0.0024)<br>n=41,776 |
| SDG&E              | 1998 | 23.10%<br>(-)<br>n=17,969                      | 25.41%<br>(-)<br>n=2,980       | 21.12%<br>(-)<br>n=4,484       | 22.83%<br>(-)<br>n=6,434       | 24.00%<br>(-)<br>n=4,071       |
|                    | 1999 | 29.80%<br>(0.0023)<br>n=39,695                 | 28.53%<br>(0.0046)<br>n=9,483  | 29.01%<br>(0.0045)<br>n=10,237 | 32.16%<br>(0.0046)<br>n=10,417 | 28.99%<br>(0.0046)<br>n=9,558  |
|                    | 2000 | 37.37%<br>(0.0024)<br>n=39,102                 | 29.53%<br>(0.0048)<br>n=9,036  | 29.99%<br>(0.0044)<br>n=10,749 | 41.96%<br>(0.0047)<br>n=10,671 | 44.66%<br>(0.0053)<br>n=8,646  |
|                    | 2001 | 28.99%<br>(0.0022)<br>n=43,135                 | 0.01%<br>(0.0010)<br>n=9,221   | 23.29%<br>(0.0039)<br>n=11,829 | 40.15%<br>(0.0045)<br>n=12,045 | 48.10%<br>(0.0050)<br>n=10,040 |
|                    | 2002 | 29.14%<br>(0.0020)<br>n=53,498                 | 27.40%<br>(0.0077)<br>n=3,318  | 31.71%<br>(0.0080)<br>n=3,330  | 34.85%<br>(0.0084)<br>n=3,185  | 30.65%<br>(0.0078)<br>n=3,524  |
|                    | 2003 | 40.20%<br>(0.0025)<br>n=38,187                 | 31.17%<br>(0.0041)<br>n=12,718 | 46.79%<br>(0.0058)<br>n=7,360  | 43.83%<br>(0.0050)<br>n=9,994  | 43.93%<br>(0.0055)<br>n=8,115  |
| Other <sup>1</sup> | 1998 | 13.90%<br>(-)<br>n=51,722                      | 13.00%<br>(-)<br>n=10,298      | 13.94%<br>(-)<br>n=12,226      | 13.87%<br>(-)<br>n=17,320      | 14.69%<br>(-)<br>n=11,878      |
|                    | 1999 | 21.69%<br>(0.0013)<br>n=108,021                | 18.56%<br>(0.0025)<br>n=24,993 | 20.11%<br>(0.0024)<br>n=27,246 | 22.82%<br>(0.0024)<br>n=30,442 | 24.72%<br>(0.0027)<br>n=25,340 |
|                    | 2000 | 25.03%<br>(0.0013)<br>n=106,155                | 22.70%<br>(0.0026)<br>n=24,868 | 23.19%<br>(0.0024)<br>n=32,094 | 26.63%<br>(0.0027)<br>n=26,179 | 27.89%<br>(0.0029)<br>n=23,014 |
|                    | 2001 | 18.95%<br>(0.0013)<br>n=97,270                 | 0.01%<br>(0.0008)<br>n=19,753  | 12.02%<br>(0.0020)<br>n=26,323 | 26.23%<br>(0.0026)<br>n=28,235 | 33.36%<br>(0.0031)<br>n=22,959 |
|                    | 2002 | 24.85%<br>(0.0011)<br>n=156,830                | 23.32%<br>(0.0023)<br>n=33,661 | 23.78%<br>(0.0021)<br>n=41,022 | 26.23%<br>(0.0021)<br>n=44,999 | 25.76%<br>(0.0023)<br>n=37,148 |
|                    | 2003 | 40.20%<br>(0.0013)<br>n=136,243                | 28.01%<br>(0.0023)<br>n=38,307 | 44.45%<br>(0.0028)<br>n=30,550 | 45.05%<br>(0.0026)<br>n=37,867 | 45.40%<br>(0.0029)<br>n=29,519 |

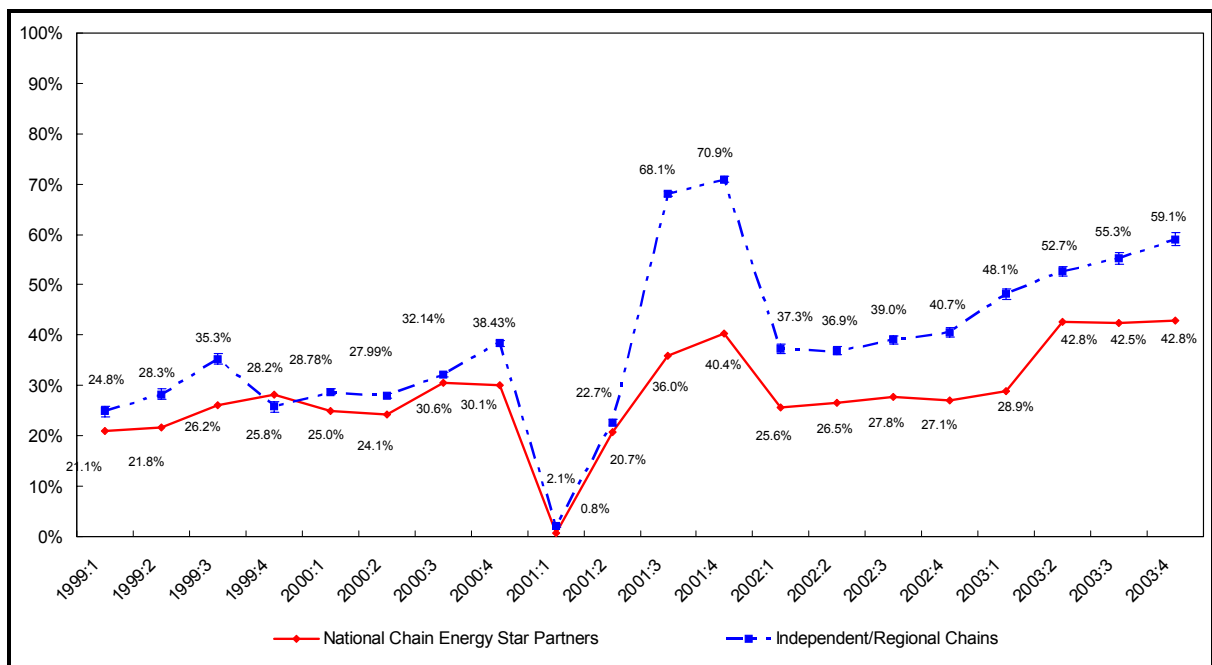
The "Other" category encompasses areas served by municipal utilities such as LADWP, LMUD, PP&L, SMUD, and others.

## 5.5 Analysis by Market Channel

### Comparison of Sales Data from National Chain and Independent Retailers

Figure 5-2 and Table 5-5 compare the market shares of ENERGY STAR qualified refrigerators sold by national chain ENERGY STAR partners to market shares of ENERGY STAR qualified refrigerators sold by independently owned stores and regional chains. With the exception of the fourth quarter of 1999,<sup>23</sup> the share sold by the national chains is lower than the share sold by the independent appliance retailers in California. The decrease in market shares in 2001 was explained above in the discussion of Figure 5-1.

**Figure 5-2: Refrigerator Sales, Percent of ENERGY STAR Qualified Units by Market Channel**



Error bands for the 90% confidence interval.

<sup>23</sup> A much smaller sample size was used for independent chains in 1999, as compared to sample sizes in 2000 and 2001, and this should be kept in mind when considering the results.



**Table 5-5: Refrigerator Sales, Percent of ENERGY STAR Qualified Units by Market Channel**

| Year/Quarter | Market Channel                      |                                  |
|--------------|-------------------------------------|----------------------------------|
|              | National Chain ENERGY STAR Partners | Independent and Regional Chains  |
| 1999:1       | 21.08%<br>(0.0012)<br>n=106,212     | 24.83%<br>(0.0069)<br>n=3,969    |
| 1999:2       | 21.79%<br>(0.0012)<br>n=116,872     | 28.32%<br>(0.0068)<br>n=4,378    |
| 1999:3       | 26.16%<br>(0.0012)<br>n=124,803     | 35.31%<br>(0.0063)<br>n=5,711    |
| 1999:4       | 28.24%<br>(0.0014)<br>n=107,273     | 25.81%<br>(0.0064)<br>n=4,664    |
| 2000:1       | 25.03%<br>(0.0014)<br>n=100,864     | 28.78%<br>(0.0037)<br>n=15,001   |
| 2000:2       | 24.14%<br>(0.0012)<br>n=127,557     | 27.99%<br>(0.0034)<br>n=17,616   |
| 2000:3       | 30.62%<br>(0.0014)<br>n=101,910     | 32.14%<br>(0.0032)<br>n=20,955   |
| 2000:4       | 30.08%<br>(0.0015)<br>n=87,641      | 38.43%<br>(0.0036)<br>n=18,752   |
| 2001:1       | 0.01%<br>(0.0003)<br>n = 93,368     | 0.02%<br>(0.0013)<br>n = 11,397  |
| 2001:2       | 20.66%<br>(0.0011)<br>n = 128,000   | 22.69%<br>(0.0031)<br>n = 18,412 |
| 2001:3       | 35.98%<br>(0.0013)<br>n = 129,037   | 68.07%<br>(0.0033)<br>n = 19,426 |
| 2001:4       | 40.43%<br>(0.0015)<br>n = 106,864   | 70.93%<br>(0.0036)<br>n = 15,506 |
| 2002:1       | 25.57%<br>(0.0011)<br>n = 147,043   | 37.27%<br>(0.0054)<br>n = 8,072  |
| 2002:2       | 26.51%<br>(0.0011)<br>n = 172,062   | 36.91%<br>(0.0050)<br>n = 9,339  |
| 2002:3       | 27.78%<br>(0.0010)<br>n = 189,973   | 39.05%<br>(0.0054)<br>n = 8,263  |
| 2002:4       | 27.07%<br>(0.0011)<br>n = 152,300   | 40.66%<br>(0.0057)<br>n = 7,542  |
| 2003:1       | 28.86%<br>(0.0011)<br>n = 164,613   | 48.14%<br>(0.0063)<br>n = 6,334  |
| 2003:2       | 42.76%<br>(0.0014)<br>n = 121,735   | 52.66%<br>(0.0098)<br>n = 7,086  |
| 2003:3       | 42.50%<br>(0.0013)<br>n = 151,690   | 55.26%<br>(0.0065)<br>n = 5,829  |
| 2003:4       | 42.78%<br>(0.0014)<br>n = 120,044   | 59.07%<br>(0.0122)<br>n = 4,381  |

Significant errors in parentheses.

**Energy Factor Analysis**

This subsection presents percentages of sales of independent or regional retailers by efficiency groupings and average EF. These results are possible due to line item detail provided by the participating independent appliance retailers throughout California. The EF-level analysis is a more accurate measure of actual efficiency trends than the ENERGY STAR analysis. In particular, the specification change for ENERGY STAR that took place in 2001 made it difficult to compare results over time.

Figure 5-3 presents the percentage of refrigerator sales by independent appliance retailers by efficiency level. Results for 2001 are presented in two halves, where “2001:1” refers to the first six months of the year, and “2001:2” refers to the latter six months of the year. As shown, during the first half of 2001, the majority of sales of refrigerators by independent retailers did not meet ENERGY STAR criteria. During the second half of the year, however, a larger proportion of units sold met or exceeded ENERGY STAR criteria. This result is likely due to ENERGY STAR basing their specification on new standards, which were not yet in effect during the first half of the year.

**Figure 5-3: Percent of Independent Refrigerator Sales by Efficiency Level**

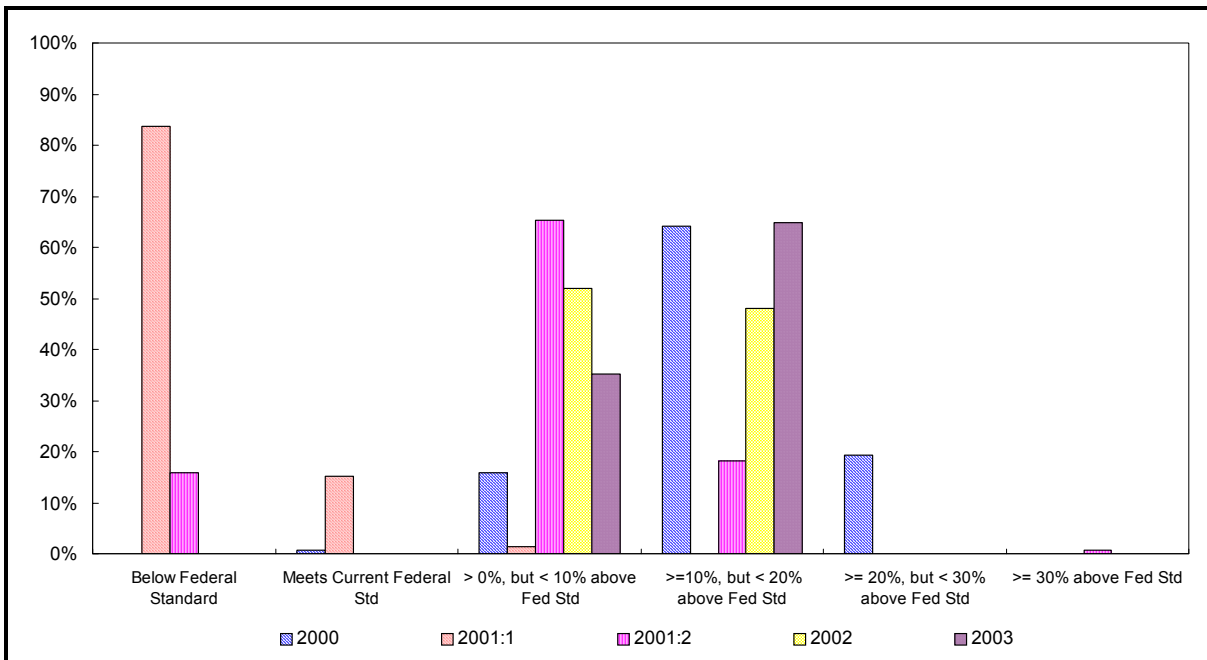
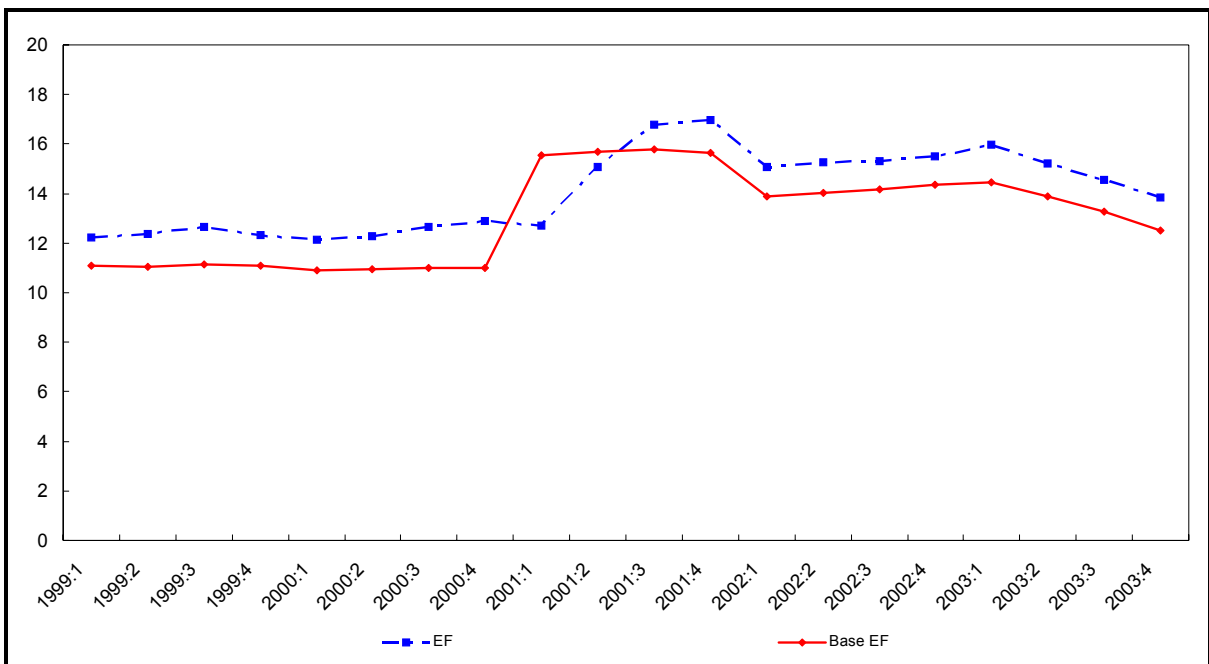


Figure 5-4 illustrates the average EF of refrigerators sold by independent appliance retailers throughout California from 2000 through 2003. In addition, a second line called the “Base EF” is included. The federal standard for each unit in the sample data is calculated, and the federal standard values are averaged across all units, to derive the Base EF. The Base EF represents the standard against which ENERGY STAR is measured. As described previously

in this section, the “Base EF” is different from the actual federal standard because, during the first two quarters of 2001, the ENERGY STAR program measured their efficiency threshold against the new federal standard, which did not take effect until July 1, 2001. As shown in Figure 5-4, both the average EF and the base EF lines exhibit a decreasing trend throughout 2003, which indicates that the share of lower-efficiency refrigerator sales by independent appliance retailers increased through 2003.

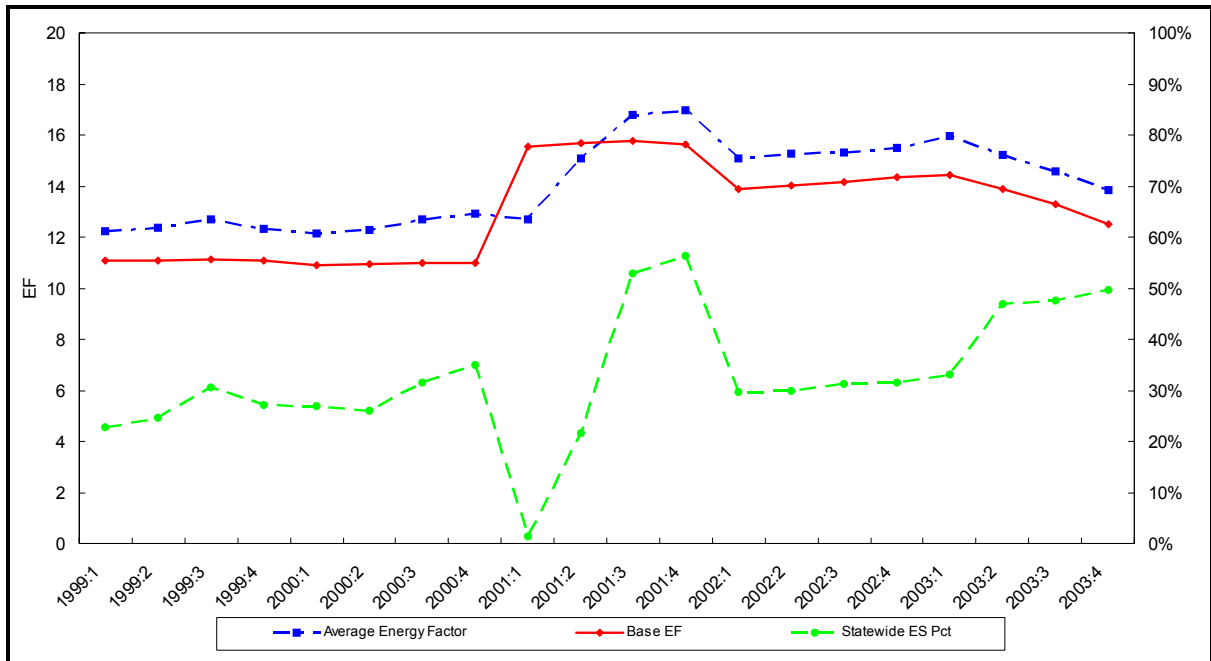
Figure 5-5 examines the relationship between the market share for independent appliance retailers of ENERGY STAR refrigerators, previously shown in Figure 5-2, and the average EFs previously shown in Figure 5-4. It is of interest due to the clear visual representation of the increase in ENERGY STAR specifications for refrigerators, which led to the lack of ENERGY STAR qualified units sold in the first quarter, since the majority of units were unable to meet the July 1, 2001 federal standard at that time.

**Figure 5-4: Average Energy Factor for Refrigerators Sold By Independent Appliance Retailers**



Base EF is the average EF for refrigerator models sold by independent retailers, calculated with the appropriate federal standard for that time against which the ENERGY STAR standard was measured. In 1999, 2000, the second half of 2001, 2002, and 2003, it is based on the actual federal standard. In the first half of 2001, however, the base EF is calculated from the new federal standard, which did not take effect until July 1, 2001.

**Figure 5-5: Comparison and Correlation of Independent Retailer Energy Factor Averages and ENERGY STAR Percentage Share for Refrigerators**



Error bands for the 90% confidence interval.

# 6

## Room Air Conditioners

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### 6.1 Overview

This section discusses total room air conditioner (RAC) unit sales, efficiency standards, market share of ENERGY STAR qualified units, and analysis of ENERGY STAR sales by market channel.

### 6.2 Total Unit Sales

Manufacturer shipment data from the Association of Home Appliance Manufacturers (AHAM) was used to estimate unit sales. After examining the data received, it was found that the number of units shipped in 2001 was significantly higher than other years, and it was unclear if all the RAC units that shipped into California during 2001 were actually sold in the state that same year. One explanation might be that the units in question were sold by the home improvement retail segment, as the units sold by this segment are not represented in either the national chain data or independent retailer sales data obtained for the RMST. However, because the number of units shipped in 2002 decreased, it is not likely that this explanation would account for all of the 2001 increase. After the initial drop in shipments from 2001 to 2002, shipments rose again in 2003.

Table 6-1 presents the estimates of annual unit sales of room air conditioners used in the development of market shares in this report. It should be noted that most room air conditioning units are typically sold during the second and third quarter of the year; due to the seasonal nature of this appliance, quarterly analysis fluctuates greatly. Thus, the results in this report are presented on an annual basis.

**Table 6-1: Estimate of Total Room Air Conditioner Unit Sales in California**

| Measure               | 1998    | 1999    | 2000    | 2001    | 2002    | 2003    |
|-----------------------|---------|---------|---------|---------|---------|---------|
| Room Air Conditioners | 231,100 | 278,600 | 279,600 | 409,200 | 316,200 | 515,900 |

Source: AHAM

### **6.3 Room Air Conditioner Energy Efficiency Standards**

The energy efficiency of room air conditioners is expressed as an Energy Efficiency Rating (EER), which varies by cooling capacity (Btuh) and configuration.

**Federal Energy Use Standard.** Federal energy efficiency standards for room air conditioners were updated on October 1, 2000. The former standards had been in effect since January 1, 1990.

**ENERGY STAR Standard.** In order to qualify for the ENERGY STAR label, room air conditioners must exceed the federal standard by at least 10%.

On October 1, 2003, the ENERGY STAR criteria for room air conditioners was expanded to include units without louvered sides, commonly referred to as "built in" or "through-the-wall" (TTW) units and the casement product classes. Units with reverse cycle were still excluded from ENERGY STAR qualification. However, since room air conditioner sales are seasonal, the impact of these changes upon 2003 results is likely to have been relatively minor since the new standard was effective only during the fourth quarter which typically has very low RAC sales.

**California Standard.** In January 2002, the CEC amended their appliance efficiency regulations to reflect and equal the increase in the federal energy use standards.

Table 6-2 summarizes the federal, state, and ENERGY STAR standards for room air conditioners by room air conditioner configuration and size.

**Table 6-2: Energy Efficiency Standards for Room Air Conditioners**

| Btuh            | Configuration                                    | Federal Standard |                 | ENERGY STAR <sup>1,2</sup> | California Standards <sup>3</sup> |
|-----------------|--|------------------|-----------------|----------------------------|-----------------------------------|
|                 |  | January 1, 1990  | October 1, 2000 | October 1, 2003            | January 1, 2002                   |
| < 6,000         | Without reverse cycle and with louvered sides    | 8.0              | 9.7             | 10.7                       | 9.7                               |
|                 | Without reverse cycle and without louvered sides | 8.0              | 9.0             | 9.9                        | 9.0                               |
| 6,000 – 7,999   | Without reverse cycle and with louvered sides    | 8.5              | 9.7             | 10.7                       | 9.7                               |
|                 | Without reverse cycle and without louvered sides | 8.5              | 9.0             | 9.9                        | 9.0                               |
| 8,000 - 13,999  | Without reverse cycle and with louvered sides    | 9.0              | 9.8             | 10.8                       | 9.8                               |
|                 | Without reverse cycle and without louvered sides | 8.5              | 8.5             | 9.4                        | 8.5                               |
| 14,000 - 19,000 | Without reverse cycle and with louvered sides    | 8.8              | 9.7             | 10.7                       | 9.7                               |
|                 | Without reverse cycle and without louvered sides | 8.5              | 8.5             | 9.4                        | 8.5                               |
| > 20,000        | Without reverse cycle and with louvered sides    | 8.2              | 8.5             | 9.4                        | 8.5                               |
|                 | Without reverse cycle and without louvered sides | 8.2              | 8.5             | 9.4                        | 8.5                               |
| < 14,000        | With reverse cycle and without louvered sides    | 8.0              | 8.5             | *                          | 8.5                               |
| ≥ 14,000        | With reverse cycle and without louvered sides    | 8.0              | 8.0             | *                          | 8.0                               |
| < 20,000        | With reverse cycle and with louvered sides       | 8.5              | 9.0             | *                          | 9.0                               |
| ≥ 20,000        | With reverse cycle and with louvered sides       | 8.5              | 8.5             | *                          | 8.5                               |
|                 | Casement only                                    | *                | 8.7             | 9.6                        | 8.7                               |
|                 | Casement slider                                  | *                | 9.5             | 10.5                       | 9.5                               |

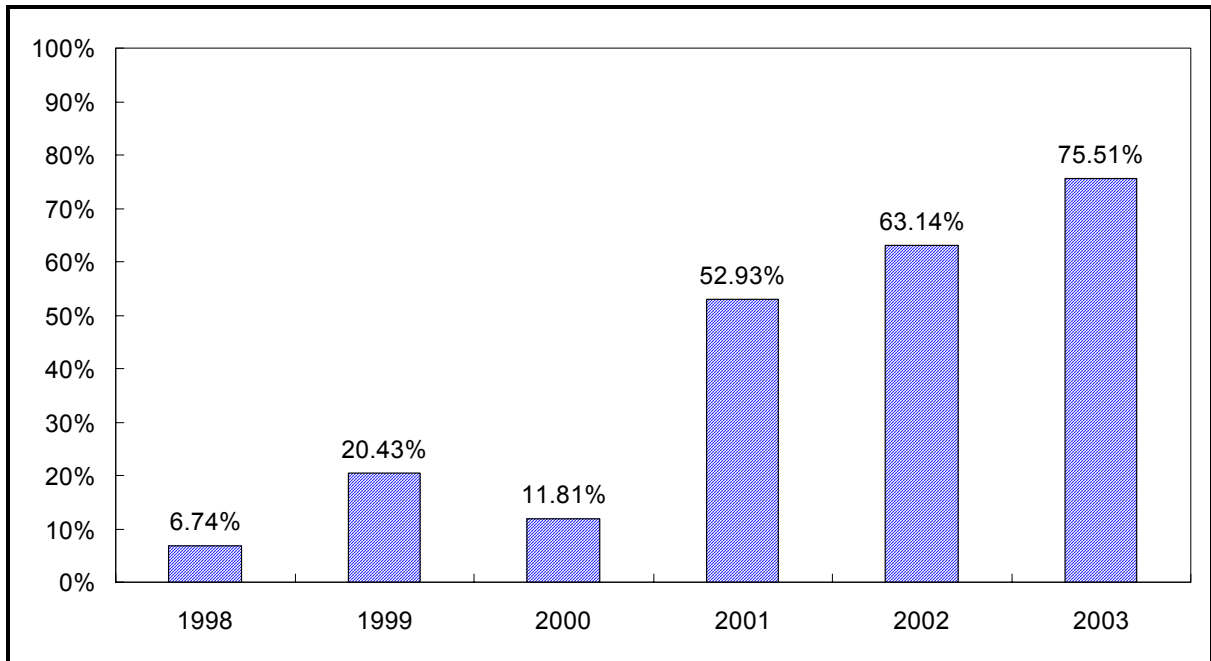
1. ENERGY STAR standards apply to Btu rating categories only.
2. Prior to October 1, 2003, room air conditioners were required to exceed federal standards by at least 15% to qualify for the ENERGY STAR label.
3. Standards for previous years discussed in further detail in previous reports.

## 6.4 Market Share of ENERGY STAR Qualified Room Air Conditioners

Figure 6-1 and Table 6-3 depict the statewide estimated share of ENERGY STAR qualified room air conditioners sold by appliance retailers annually from 1998 through 2003. As shown, the market share of ENERGY STAR room air conditioners has increased dramatically during the past four years, reaching 75.5% in 2003. Note that, although results are shown annually, most sales typically occurred during the middle two quarters of each year.

Table 6-4 presents the same information by utility area. As shown in Table 6-4, the PG&E service territory reported the highest proportion of ENERGY STAR qualified room air conditioner sales, at 80.9%, followed by the “Other” service territory, the SCE service territory, and the SDG&E service territory, at 58.9%, 58.1%, and 52.1%, respectively.

**Figure 6-1: Room Air Conditioner Sales, Annual Percent of ENERGY STAR Qualified Units**



**Table 6-3: Room Air Conditioner Sales, Percent of ENERGY STAR Qualified Units, Statewide**

| Year | Annual Percent of ENERGY STAR Qualified Room Air Conditioners |
|------|---|
| 1998 | 6.73%<br>(-)<br>n = 19,087                                    |
| 1999 | 20.43%<br>(0.0038)<br>n = 11,176                              |
| 2000 | 11.81%<br>(0.0016)<br>n = 42,562                              |
| 2001 | 28.80%<br>(0.0024)<br>n = 35,003                              |
| 2002 | 63.14%<br>(0.0024)<br>n = 39,504                              |
| 2003 | 75.51%<br>(0.0017)<br>n = 62,603                              |

Standard errors in parentheses.



**Table 6-4: Room Air Conditioner Sales, Percent of ENERGY STAR Qualified Units by Utility Service Area**

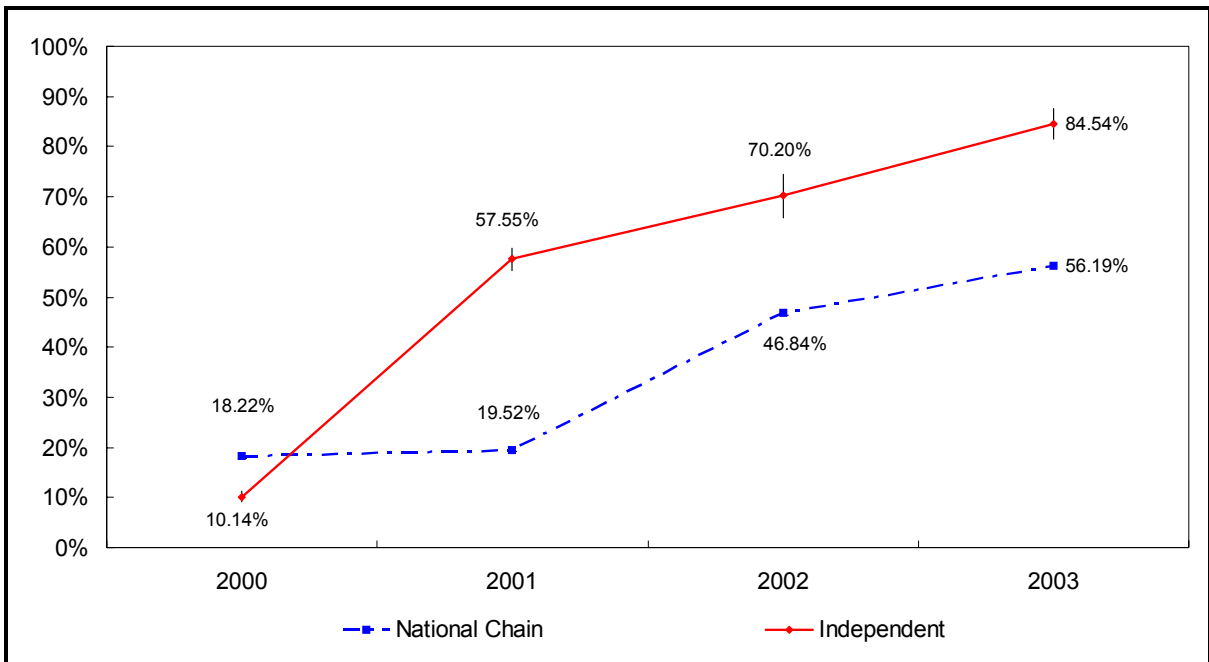
| Utility            | Year | Annual Percent of ENERGY STAR Qualified Room Air Conditioners <sup>1,2</sup> |
|--------------------|------|--|
| PG&E               | 1998 | 6.41%<br>(-)<br>n = 5,636  |
|                    | 1999 | 21.65%<br>(0.0073)<br>n = 3,217  |
|                    | 2000 | 14.22%<br>(0.0028)<br>n = 16,007   |
|                    | 2001 | 80.46%<br>(0.0037)<br>n = 11,331   |
|                    | 2002 | 67.71%<br>(0.0043)<br>n = 12,105   |
|                    | 2003 | 80.90%<br>(0.0031)<br>n = 16,323   |
| SCE                | 1998 | 5.88%<br>(-)<br>n = 6,118  |
|                    | 1999 | 6.46%<br>(0.0041)<br>n = 3,576   |
|                    | 2000 | 8.54%<br>(0.0025)<br>n = 13,017  |
|                    | 2001 | 28.58%<br>(0.0042)<br>n = 11,322   |
|                    | 2002 | 44.80%<br>(0.0045)<br>n = 12,024   |
|                    | 2003 | 58.12%<br>(0.0034)<br>n = 21,629   |
| SDG&E              | 1998 | 4.53%<br>(-)<br>n = 728  |
|                    | 1999 | 6.35%<br>(0.0154)<br>n = 252   |
|                    | 2000 | 15.83%<br>(0.0083)<br>n = 1,927  |
|                    | 2001 | 18.92%<br>(0.0105)<br>n = 1,401  |
|                    | 2002 | 43.58%<br>(0.0126)<br>n = 1,558  |
|                    | 2003 | 52.16%<br>(0.0093)<br>n = 2,914  |
| Other <sup>1</sup> | 1998 | 8.05%<br>(-)<br>n = 6,605  |
|                    | 1999 | 6.71%<br>(0.0039)<br>n = 4,131   |
|                    | 2000 | 17.01%<br>(0.0310)<br>n = 147  |
|                    | 2001 | 16.94%<br>(0.0036)<br>n = 10,949   |
|                    | 2002 | 47.49%<br>(0.0042)<br>n = 13,817   |
|                    | 2003 | 58.93%<br>(0.0033)<br>n = 21,737   |

1. "Other" includes areas served by municipal utilities such as LADWP, SMUD, and others.

## 6.5 Analysis by Market Channel

Figure 6-2 and Table 6-5 present market shares of ENERGY STAR room air conditioners for independent retailers and national chains. As shown, over the past two years, a greater percentage of sales through independent retailers are ENERGY STAR units as compared to sales of national chains. For example, in 2003, 85% of independent retailer sales of room air conditioners were ENERGY STAR units, while roughly 56% of national chain sales qualified as ENERGY STAR. However, it is important to understand that room air conditioner sales are increasingly sold by larger chain stores. Overall, as shown in Figure 6-2, the percentage of units sold that meet the ENERGY STAR qualification is increasing for both independent retailers and national chains.

**Figure 6-2: Room Air Conditioner Sales, Annual Percent of ENERGY STAR Qualified Units by Market Channel**



Error bands for the 90% confidence interval.

**Table 6-5: Room Air Conditioner ENERGY STAR Sales by Market Channel**

| Year/Quarter | Market Channel                          |                                       |
|--------------|---|---------------------------------------|
|              | National Chain ENERGY STAR Partners     | Independent and Regional Chains       |
| <b>2000</b>  | <b>11.58%</b><br>(0.0005)<br>n =367,970 | <b>10.14%</b><br>(0.0063)<br>n =2,314 |
| <b>2001</b>  | <b>16.32%</b><br>(0.0006)<br>n =399,461 | <b>30.09%</b><br>(0.0122)<br>n =1,408 |
| <b>2002</b>  | <b>46.84%</b><br>(0.0025)<br>n =399,202 | <b>70.20%</b><br>(0.0263)<br>n =302   |
| <b>2003</b>  | <b>56.19%</b><br>(0.0020)<br>n = 62,215 | <b>84.54%</b><br>(0.018)<br>n = 388   |

Standard errors in parentheses.

# 7

## Work in Progress and Seventh-Year Tracking Activities

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In the seventh year, the project team looks forward to continuing the positive relationship forged with D&R International. The continuing seventh-year efforts will also focus on:

- Producing updated individual summaries for participating independent retailers,
- Maintaining the participating independent retailer level by regular contact/relationship building, and
- Assisting D&R International with their efforts to recruit their ENERGY STAR partner home improvement retailers to share appliance sales data.

Itron will also continue monitoring changes in federal standards (National Appliance Energy Consumption Act or NAECA) or testing procedures. The impact of these changes, such as the transition to the modified EF, will be evaluated.

# Appendix A

## Data Detail and Analysis

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### A.1 Appliance ENERGY STAR Sales Data Analysis

Itron analyzed sales data for each tracked appliance in order to estimate the statewide market share for each of these appliances. This was done by estimating the percent of units sold for each appliance that met ENERGY STAR qualifications from the first quarter of 1999 through 2003 based upon sales data provided by national chain appliance retailers and independent appliance retailers throughout California.<sup>1</sup>

#### ***Data Processing***

A considerable amount of effort is needed to transform the raw data collected from the various sources into a common format that will support this analysis. This process is discussed below for national retail chain data and for independent and regional chain data.

***National Retail Chain Data.*** The national chain sales data provided by D&R was converted into the same format as the independent data. Part of this conversion included the addition of a variable that indicated the percent above standard for each appliance sale shown. Since ENERGY STAR specifications vary by appliance type, this variable functioned as the mechanism by which ENERGY STAR sales were distinguished from non-ENERGY STAR sales.

***Independent and Regional Chain Data.*** The data received from independent and regional chains was first converted to a common electronic format. For example, hard copy data were coded into an electronic database. The required efficiency parameters were then electronically merged to the sales data by the manufacturer model numbers provided in the sales data. Itron obtained efficiency parameters for ENERGY STAR-qualified appliances from the California Energy Commission's Appliance Efficiency Database and the ENERGY STAR website. Additionally, for clothes washers and dishwashers, Itron staff obtained efficiency data directly from manufacturers, procuring information directly from their websites whenever possible. Additionally, telephone calls were made to obtain information for older models or for manufacturers without websites. For refrigerators and room air

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<sup>1</sup> The 1998 analysis was based on national chain sales data only since independent appliance retailer data was not available for that time frame.

conditioners, AHAM's Directory of Certified Refrigerators and Freezers was utilized to supplement the efficiency data obtained.<sup>2</sup> In addition to the efficiency or energy factor data, a variable that indicates the percent above efficiency standard for each model for the independent data was created in order to identify the various efficiency levels of units sold compared to the federal standard.

### **Appliance Sales Analysis**

The general analysis involved estimation of the share of appliances sold that met or exceeded the ENERGY STAR qualification threshold. In particular, Itron estimated the percentage of ENERGY STAR compliant units of each appliance sold in California and for the investor-owned utility service areas on an annual and quarterly basis from the first quarter of 1998 through the fourth quarter of 2003.

Two key points are worth noting regarding the appliance sales analysis. First, as noted in Table 2-5, the sample of retailers that provided 1998 is different from the sample that provided 1999 data. Specifically, in 1998 only two national chain retailers provided sales data, whereas four national chains and a panel of independent retailers provided data in 1999. To account for differences between the 1998 and 1999 data, the 1998 data were adjusted based on the ratio of the estimated percent of ENERGY STAR units sold during 1999 to the percent of ENERGY STAR units sold by national chains in 1999. Second, expansion weights were developed according to the sample design for this component of the project. In particular, separate expansion weights were developed for national chain sales and sales by independently owned retailers. This was particularly important because of speculation by industry professionals that retailers in the two market channels behave differently with respect to the product mixes they typically stock and sell.

**Expansion Weights.** Itron developed weights to expand the sample to the total sales of each appliance in California and each utility service area. This required the estimation of 1) total appliance sales in California and each utility service area, and 2) total appliance sales through each market channel.

To estimate the total appliance sales in each utility area, Itron developed the ratio of the total number of households in each utility service area to the total number of households in California. This ratio was used to estimate the proportion of total sales of each appliance in each utility service area for each year, based on total appliance shipments to California as published by AHAM.

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<sup>2</sup> California Energy Commission. Appliance Efficiency Database. [www.energy.ca.gov/efficiency/appliances](http://www.energy.ca.gov/efficiency/appliances). Association of Home Appliance Manufacturers. *AHAM Directory of Certified Refrigerators and Freezers. January and June Editions.* 1997 through 2000.

$$N_{ua} = \frac{P_u}{P_{CA}} \times S_{CAau}$$

where:

- $N_{ua}$  is an estimate of total sales of appliance  $a$  for utility  $u$ .
- $P_u$  is the total number of households in each utility's  $u$  service area.
- $P_{CA}$  is the total number of households in California.
- $S_{CAa}$  is the total shipments of appliance type  $a$  to California.

To estimate total sales for each market channel, Itron estimated the total sales of each appliance by national chains by expanding the sales provided in the D&R database (representing two chains) to represent sales by all ENERGY STAR partner national chains. Because total unit sales by individual chains are not known, Itron expanded sales by a revenue-multiplier as a proxy for total unit sales:<sup>3</sup>

$$N_{ua}^{nc} = n_{ua}^{nc} \left( \frac{R_{ua}^{nc}}{r^{nc}} \right)$$

where:

- $N_{ua}^{nc}$  is the total estimated sales of appliance  $a$  in utility area  $u$  by all national chain ( $nc$ ) stores.
- $n_{ua}^{nc}$  is the reported sales by national chain ( $nc$ ) ENERGY STAR partners of appliance  $a$  for utility  $u$ .
- $R_{ua}^{nc}$  is the total revenues from appliance sales by all national chain ( $nc$ ) ENERGY STAR partners in 1999.<sup>4</sup>
- $r^{nc}$  is the total revenues from appliance sales by the national chain ( $nc$ ) retailers in the analysis sample in 1999.

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<sup>3</sup> D&R International provided revenue data to Itron for creation of revenue multipliers.

<sup>4</sup> Revenue data for subsequent years were not available to update the revenue-multiplier. Therefore, the 1999 proxy was used for 2000-2003.

Total sales by the independent retail channel is assumed to be the remainder of market, or

$$N_{ua}^{in} = N_{ua} - N_{ua}^{nc}$$

where:

$N_{ua}^{in}$  is the total sales of appliance  $a$  for utility  $u$  by all independent retailers (*in*).

The expansion weights for each appliance  $a$  sold in each utility area  $u$  for sales by the national chain ENERGY STAR partners and independent retailers are computed as the ratio of total units sold to the units sold represented in the analysis sample:

$$w_{ua}^{nc} = \frac{N_{ua}^{nc}}{n_{ua}^{nc}}$$

$$w_{ua}^{in} = \frac{N_{ua}^{in}}{n_{ua}^{in}}$$

where:

$w_{ua}^{nc}$  is the expansion weight applied to all sales by the national chain ENERGY STAR partners in the sample, and

$w_{ua}^{in}$  is the expansion weight applied to all sales by independently owned retailers in the sample.

Shares of ENERGY STAR qualifying appliances during each quarter were estimated by expanding the sales in the database by the appropriate expansion factor and computing the percent of the expanded sales that qualify for the ENERGY STAR label.<sup>5</sup>

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<sup>5</sup> Because 1998 sales data did not accurately represent California's appliance market, Itron developed a rather simplistic approach to estimating the shares of ENERGY STAR appliances representing the entire market. In particular, the share of ENERGY STAR qualified sales of each appliance developed from the 1998 data was multiplied by the ratio of the share of ENERGY STAR sales in 1999 by the national chains in the 1998 sample to the share of ENERGY STAR sales in 1999 by the four national chains in the 1999 sample.