

California Residential Efficiency Market Share Tracking

HVAC 2005

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December 15, 2006

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1

Introduction

The California HVAC Report 2005 presents the analysis of HVAC equipment sales for residential use in California and the U.S. from 1998 through 2005.¹ This research is one component of the California Residential Market Share Tracking (RMST) project, which has monitored the market penetration of energy efficient measures in California since 1999.² The RMST project supports California's investor-owned utilities (IOUs) in their program planning and efforts to measure statewide and IOU-specific program milestones for promoting short-term adoption of measures and longer-term market acceptance of energy efficient technologies. In addition to residential gas furnaces, central air conditioners, and heat pumps, the RMST project estimates the average efficiency rating and market penetration of high efficiency refrigerators, clothes washers, dishwashers, and room air conditioners.³ The RMST project also examines the market penetration of compact fluorescent and other medium screw-based lamps. In addition to the California IOUs, beneficiaries of this research includes federal and state agencies, regional and state energy efficiency organizations, trade organizations, equipment manufacturers, distributors, and retailers.

This report presents the total estimated unit sales, average efficiencies, and percent of ENERGY STAR[®] qualified units sold in the state for three types of HVAC equipment: central air conditioners (CACs), air-source heat pumps, and central gas furnaces. Results are also presented by utility service area or aggregated service areas when the data cannot support such segmentation. This report also contains general market information and efficiency standards for each equipment type, including federal energy use standards, national ENERGY STAR program standards, and California's appliance efficiency standards.⁴

Of particular interest regarding this study is the consistency of input data over time. Since the inception of the study, Itron has obtained sales data from a panel of HVAC equipment

¹ A four-page companion report titled *California HVAC Trends 2005* summarizes the findings in this report.

² This project is managed by Southern California Edison.

³ Annual RMST reports detailing CFL sales, residential appliance sales, and HVAC sales in California since 2000 can be downloaded from <http://www.calmac.org/>.

⁴ Although past reports also incorporated detailed estimates and analysis of HVAC equipment installed in newly constructed homes throughout California, this report focuses on overall equipment sales.

distributors serving the residential new construction and contracting markets throughout California. The consistent and ongoing nature of the data collection process has produced valuable and meaningful trends of HVAC equipment sales.

This report includes an additional analysis that focuses on the relationship between the SEER and EER ratings for CACs. The SEER rating, otherwise known as the Seasonal Energy Efficiency Ratio, measures the average efficiency of a cooling system over an entire cooling season. The Energy Efficiency Ratio, or EER for short, is designed to measure performance of cooling systems when they operate on “peak days.” These peak days are the hottest days when air cooling systems work their hardest.⁵ Both ratings provide information regarding the performance of air conditioners but focus on slightly different aspects of air cooling.

The remainder of this report is organized as follows:

- Section 2 details the data collection and analysis methodologies used to develop the market share and average efficiency estimates.
- Section 3 presents the RMST results for CACs.
- Section 4 presents the RMST results for heat pumps.
- Section 5 presents the RMST results for central gas furnaces.
- Section 6 summarizes key results.

⁵ PG&E. “Buying an Air Conditioner? Remember the EER!” Technical Sheet. 2006.

2

Data Collection and Methodology

The data collection methodology adopted for the HVAC component of the RMST is based upon recommendations of the Efficiency Market Share Tracking Needs Assessment and Scoping Study (Scoping Study).⁶ The Scoping Study found that obtaining HVAC equipment sales data at the distribution level was appropriate and cost-effective relative to other alternatives.⁷ The disadvantage, however, is that distributor-level data can be limiting due to the inability to distinguish the market event (i.e., new construction versus replacement installations), since both builders and contractors purchase equipment from HVAC distributors.

The project team recruited a panel of equipment distributors to provide sales data for the HVAC equipment analysis. The data collected from distributors are used to estimate average energy efficiency ratings and shares of ENERGY STAR qualified equipment in the California residential market.

The remainder of this subsection describes the development of the distributor sample frame and sampling plan, the protocol for recruiting the distributor panel, and construction of the HVAC sales database.

2.1. Distributor Sample Frame

Iron developed the frame of equipment distributors from a variety of resources, including contacts developed from past residential sector research, HVAC equipment manufacturer web sites, the North American Heating, Refrigeration & Air Conditioning Wholesalers Association's (NRHAW) on-line membership directory, and referrals from other distributors. As shown below in Table 2-1, the RMST distributor sample frame consists of 16 companies whose primary business is the wholesale of residential space heating and cooling equipment.⁸ As shown, the frame is further segmented by geographic region and distributor type

⁶ RER, Inc. *Efficiency Market Share Needs Assessment and Feasibility Scoping Study*. Prepared for the California Board for Energy Efficiency and Pacific Gas and Electric. May 1999.

⁷ *Ibid.*

⁸ The HVAC equipment wholesale market has undergone a great deal of consolidation, thus some companies in the sample frame are owned by the same corporation.

(independent or manufacturer dealer). The frame consists of distributors that represent all major residential equipment manufacturers and brands, including Bryant, Carrier, Goodman, Lennox, Payne, Trane, and York. The frame includes independent equipment wholesalers, independently owned manufacturer dealerships, and manufacturer-owned dealers, representing well over 200 branch/warehouse locations throughout California.⁹

Table 2-1: HVAC Distributor Sample Frame

	Distributors
Total in Frame	16
with Statewide Service Areas	5
with Primarily Southern California Service Area	6
with Primarily Northern California Service Area	5
Manufacturer Dealers	4
Independent Dealers	12

2.2. Distributor Recruiting Protocol and 2005 Panel

Recruiting HVAC distributors to provide sales data can be challenging for many reasons. First, nearly all companies consider their sales data to be competitively sensitive information and most are reluctant to consider sharing it, even with assurances of confidentiality. Second, most companies are reluctant to commit the resources (i.e., staff time) to pull the required data from their inventory and sales records. Understandably, pulling data for the RMST project is a low priority for distributors. Third, the HVAC equipment market in California has consolidated considerably throughout the past five to ten years. The resulting larger companies maintain more centralized inventory and sales systems and have more centralized decision-making authority within the parent companies. Individuals at the corporate level are more hesitant to release sales data than small business owners are because of increased confidentiality concerns.

Itron’s efforts to overcome these challenges have been ongoing since the inception of the RMST project. The recruiting strategy follows the following principles.

- **Develop and Maintain Long-Term Relationships.** The distributor data collection efforts must be considered a long-term, ongoing process. Most distributors are only willing to participate if there is a long-term commitment. Due

⁹ In general, HVAC distributors have experienced some consolidation since the publication of the First-Year Interim Report. For consistency, the project team considers subsidiaries as separate entities for all subsequent HVAC reports, even though they are owned by the same parent company.

- to the sensitive nature of the data provided, trust and a positive working relationship between project staff and the distributors have proven to be paramount.
- **Guarantee Confidentiality.** Itron guarantees the confidentiality of all information and sales data provided by distributors. To ensure this, the team agreed to report efficiency market shares and any other information only at an aggregated level (statewide and by utility service area if possible).
 - **Minimize Burden and Be Flexible.** Participation in the panel has been tailored to accommodate the requirements of each distributor. For example, since distributors have different inventory and sales systems, Itron accepts data in a variety of formats to minimize the time and effort required by the participants to provide the data.
 - **Provide Value.** It is important that the participating distributors be provided something of value in return for the valuable data they contribute to the project. Itron prepares a confidential vendor level sales summary report for each participating distributor. These custom reports have received positive feedback not only from the distributors themselves, but also from the manufacturers with whom they do business.

Itron did not conduct additional recruiting for the 2005 RMST HVAC panel because Itron is in the final year of the RMST contract. Therefore, only members of the 2004 RMST HVAC panel were contacted for 2005 sales data. Itron was able to retain three out of the four distributors from the 2004 panel. The three companies that comprise the 2005 distributor panel represent 65 warehouse locations throughout the state. Sales from the 2005 distributor panel approximate 23% of the statewide central air conditioner, heat pump, and gas furnace markets.

2.3. Distributor Sales Database Construction

HVAC equipment distributors have provided sales data from the first quarter of 1999 through the fourth quarter of 2005 for the RMST HVAC project. The distributors have provided Itron with data in two different basic formats, each with differing levels of detail. Some provided quarterly summary reports of sales segmented by predetermined efficiency ranges. Others provided line-item quarterly sales reports that included manufacturer model number, quantity, and date sold.

After converting all data files into a common format, Itron linked key efficiency parameters (i.e., SEER, EER, and AFUE) to each observation in the database using one of two methods. In cases where the distributor provided the manufacturer's model number, Itron merged efficiency characteristics from the CEC's Database of Energy Efficient to each observation in

the RMST HVAC sales database.¹⁰ In cases where the efficiency parameters could not be matched electronically to the provided model number (usually because of differences in model number formats and characters), Itron obtained the required data from manufacturers' websites or by contacting the manufacturer directly. In cases where distributor data were already grouped by equipment type and efficiency level, sales data were directly added to the RMST sales database.

After all observations in the HVAC database are assigned corresponding efficiency characteristics, Itron weights each observation to represent the population of HVAC sales in California.¹¹ For the newly added EER analysis section, each observation is weighted by the quantity sold. This process results in a database of quarterly HVAC equipment sales from 1999 through 2005.

2.4. Unit Sales Analysis

HVAC equipment sales data are analyzed and reported in three ways:

- The market share of CACs, air-source heat pumps, and central gas furnaces sold that met or exceeded the ENERGY STAR qualification threshold from 2000 through 2005,
- The average efficiency ratings of units over time, and
- The percentage of statewide sales by efficiency categories.

The share of ENERGY STAR qualified CACs and central gas furnaces are examined at the statewide and utility service area levels. Results for heat pumps are presented only at the statewide level due to insufficient data at the utility region and insufficient information regarding the overall installations or sales of heat pumps. As a result, Itron could not develop accurate weights for the statewide level analysis.

¹⁰ California Energy Commission *Database of Energy Efficient Appliances*. (See: <http://www.energy.ca.gov/appliances/appliance/>)

¹¹ Expansion weights are developed at the utility service area level and are based upon number of households, equipment saturations, equipment useful life estimates, and new housing starts.

3

Central Air Conditioners

3.1. Overview

This section presents the efficiency market shares and average efficiencies of central air conditioners (CACs) purchased in California’s residential sector. Subsection 3.2 summarizes energy efficiency standards for CACs; Subsection 3.3 includes estimates of total CAC sales in California by decision type (new construction, retrofit, or replacement). Estimates of the share of ENERGY STAR qualified units sold are presented in Subsection 3.4. Subsection 3.5 presents the average SEER efficiency of CAC sales sold in California, as well as the distribution of CAC sales by SEER category. Subsection 3.6 presents the EER analysis results, which is a new addition to the HVAC report.

3.2. Central Air Conditioner Efficiency Standards

The primary cooling efficiency rating used to rate CACs is the Seasonal Energy Efficiency Ratio (SEER). This rating represents a unit’s efficiency over the length of the cooling season by comparing total cooling to total energy input—the higher the SEER rating, the more efficient the cooling equipment.¹² SEER ratings range from 9.7 to over 16.

An alternate rating system for CACs is the Energy Efficiency Ratio (EER). EER measures cooling unit performance on “peak days,” which is when air conditioners are utilized the most. EER testing is conducted at the relatively high temperature of 95°F, whereas SEER testing is conducted at a relatively moderate temperature of 82°F.¹³ EER is considered to be the “steady-state rate of heat energy removal (e.g., cooling capacity) by the equipment in Btuh divided by the steady-state rate of energy input to the equipment in watts.”¹⁴

¹² According to ARI SEER is *the total heat removed from the conditioned space during the annual cooling season, expressed in Btu’s, divided by the total electrical energy consumed by the air conditioner or heat pump during the same season, expressed in watt-hours*. However, as noted below, testing is conducted at 82 degrees at a particular cycling rate.

¹³ PG&E. “Buying an Air Conditioner? Remember the EER!” Technical Sheet. 2006.

¹⁴ [http://yosemite1.epa.gov/estar/consumers.nsf/attachments/HVACSpec2.pdf/\\$File/HVACSpec2.pdf?](http://yosemite1.epa.gov/estar/consumers.nsf/attachments/HVACSpec2.pdf/$File/HVACSpec2.pdf?OpenElement)
OpenElement, pp 4.

Many combinations of SEER and EER air conditioning units are available. Having a high SEER value does not necessarily translate to a high EER value since the two ratios are based on differing operating conditions.¹⁵ A cooling unit may be more energy efficient in moderately warm weather over the summer season, but uses a great deal of energy on the hottest days. In this case, the CAC would have a relatively high SEER rating, but lower EER rating. Finding a unit with high EER and SEER ratings ensures high efficiency at a range of temperatures, but the tradeoff is the additional cost of such a system.

A summary of federal, state, and ENERGY STAR minimum efficiency standards for CACs is provided in Table 3-1. A new federal efficiency standard became effective January 23, 2006, which increased the minimum allowable efficiency from 10 SEER to 13 SEER for both split systems and packaged units.^{16,17} This standards change resulted in a 30% improvement in SEER and delivers about 23% energy savings compared to 10 SEER models.¹⁸

In addition to the federal standard, the California Appliance Efficiency Regulations specify energy use standards for CACs.¹⁹ The CEC matched the federal standards change by increasing the minimum SEER level for CAC units to 13 SEER.²⁰ These revisions also became effective on January 23, 2006.

ENERGY STAR program requirements for CACs were also revised and new standards became effective on April 1, 2006. Under the 2006 standards, CACs must have an efficiency rating of at least 14 SEER/11.5 EER for split systems and 14 SEER/11 EER for single systems.²¹ A second phase, effective on January 1, 2009, will further increase the qualifying requirements to 14.5 SEER/12 EER for split systems.

¹⁵ PG&E. "Buying an Air Conditioner? Remember the EER!" Technical Sheet. 2006.

¹⁶ Required efficiency for residential central air conditioners less than 65 kBtu/hr.

¹⁷ Department of Energy, Office of Energy Efficiency and Renewable Energy. 2000. *Federal Register. Energy Conservation Program for Consumer Products: Central Air Conditioners and Heat Pumps Energy Conservation Standards; Proposed Rule*. Title 10, Chapter II, Subpart C, Part 430, Section 430.32.

¹⁸ DOE. *Federal Register. Central Air Conditioners and Heat Pumps*. 10 CFR Part 430.

¹⁹ California Energy Commission. *California Code of Regulations, Title 20: Division 2, Chapter 4: Energy Conservation, Article 4: Appliance Efficiency Regulations, Section 1601-1608*. January 22, 2002.

²⁰ This action occurred to comply with Assembly Bill 970- California Energy Security and Reliability Act of 2000, which was signed into law on September 6, 2000. Section 399.15 of this legislation required evaluation and improvement of energy efficiency and DSM programs throughout the State. In response, the Commission decided to increase the standards for a multitude of appliances.

²¹ Energy Star Program Requirements for Air Source Heat Pumps (ASHP) and Central Air Conditioner Equipment. Eligibility Criteria. Version 4.0. (See http://www.energystar.gov/index.cfm?c=revisions.revisions_specs.)

Since 2002, the ENERGY STAR program has specified a combined SEER and EER rating system instead of just basing its requirements on SEER. The ENERGY STAR program included EER as part of the new specification to address peak load energy performance issues, which are not reflected in SEER ratings.

Note that the CAC sales data presented in the current report were analyzed under the ENERGY STAR standard that was in effect from October 2002 to December 2005, since the current report only addresses sales data and efficiency trends through 2005. To qualify for the ENERGY STAR label during October 2002 to December 2005, CACs must have been at least 13 SEER for a split system and 12 SEER for a packaged unit. The analysis of 2006 CAC sales data in next year's report will adopt the 2006 ENERGY STAR standard.

Table 3-1: Comparison of Federal, ENERGY STAR, and California Energy Commission Energy Standards for Residential Central Air Conditioners

	Split Systems (SEER)	Split Systems (EER)	Single Package Equipment (SEER)	Single Package Equipment (EER)
Federal				
1992 Standard	10	n/a	9.7	n/a
Current/2006 Standard	13	n/a	13	n/a
Percent Improved*	30%	n/a	34%	n/a
ENERGY STAR				
2002 Standard	13	11	12	10.5
Current/2006 Standard (Tier 1)	14	11.5	14	11
January 1, 2009 Standard (Tier 2)	14.5	12	14	11
California Standards				
1995 Standard	10	n/a	9.7	n/a
Current/2006 Standard	13	n/a	13	n/a

*The percent improvement reflects the change in SEER rating, not the decrease in energy usage.

3.3. Total Unit Sales, New Construction Installations, and Retrofit, Replacement, and Net Acquisition Estimates

Table 3-2 presents estimated CAC unit sales from 1999 through 2005. Itron developed the 1999 data by examining national shipment data from Appliance Magazine, shipments estimates from the Air Conditioning and Refrigeration Institute (ARI), and subsequently cross-referencing that information with the CEC.²² The 2000 through 2005 data were developed through a process that examined the total number of households, new housing starts in California, and residential new construction on-site survey data.²³ Both the statewide and new construction data were scaled to estimate California’s annual sales based on the number of households and updated measure saturations. Retrofit/replacement units are then estimated as the difference between total units sold and units for new construction. Currently, there is no publicly available definitive source of annual unit sales at the state level, nor is there information that indicates whether units sold or shipped would be installed as retrofit/replacement units or in new construction.

Table 3-2: Estimates of California’s Annual Central Air Conditioner Sales by Decision Type

Year	Total Unit Sales	New Construction	Retrofit/ Replacement
1999	441,000	80,900	360,100
2000	444,000	99,100	344,900
2001	440,800	95,900	344,900
2002	448,800	115,700	333,100
2003	517,400	149,700	367,700
2004	546,400	150,200	396,200
2005	560,800	163,300	397,500

Figure 3-1 illustrates estimated quarterly CAC sales from 2000 through 2005.²⁴ Itron developed these data from utility service area weighted sales data obtained from the RMST HVAC distributor panel. Cooling equipment sales exhibit seasonal trends, as evidenced by the increase in sales during warmer weather and the decrease in sales as the weather cools.

²² See: http://www.appliancemagazine.com/mm/stats/html/december_1999.html, <http://www.ari.org/sr/1999/sr9912.pdf>, and

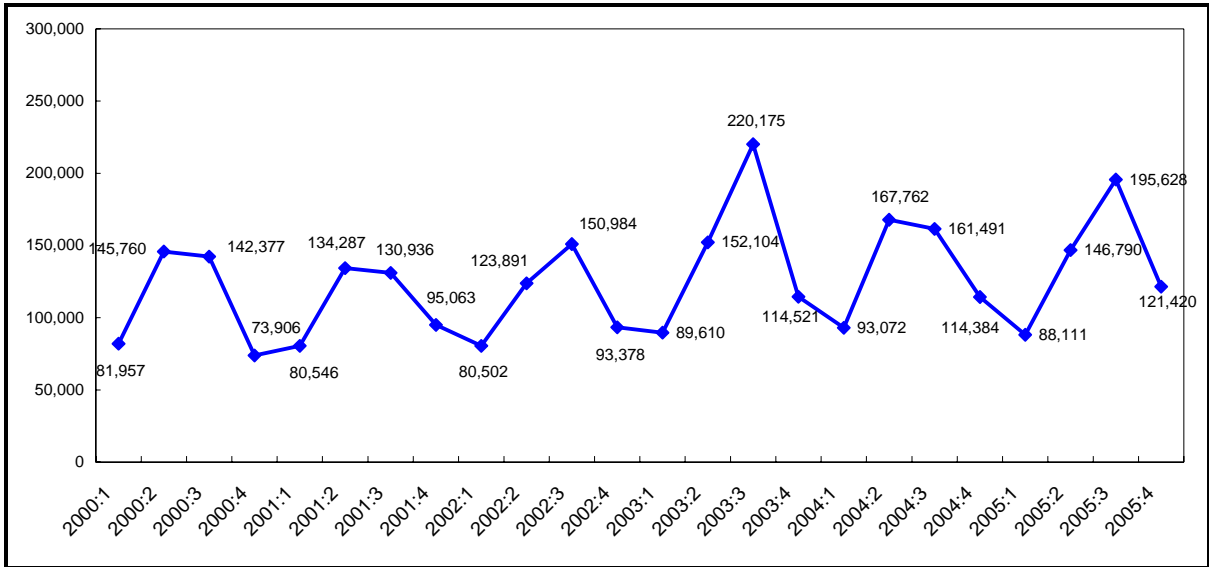
California Energy Commission. July 1995. *Staff Report California Energy Demand: 1995-2015*.

²³ Number of households from the U.S. Census. For estimates of new construction see:

RER, Inc. September 2002. *Residential New Construction Study – Year #2*. Prepared for Pacific Gas & Electric Company.

²⁴ Figure 3-1 does not correspond to Table 3-1 because the supporting data were developed from different sources representing different points in the equipment distribution channel (publicly available shipment data versus the distributor panel sales data).

Figure 3-1: Estimated California Central Air Conditioner Quarterly Sales

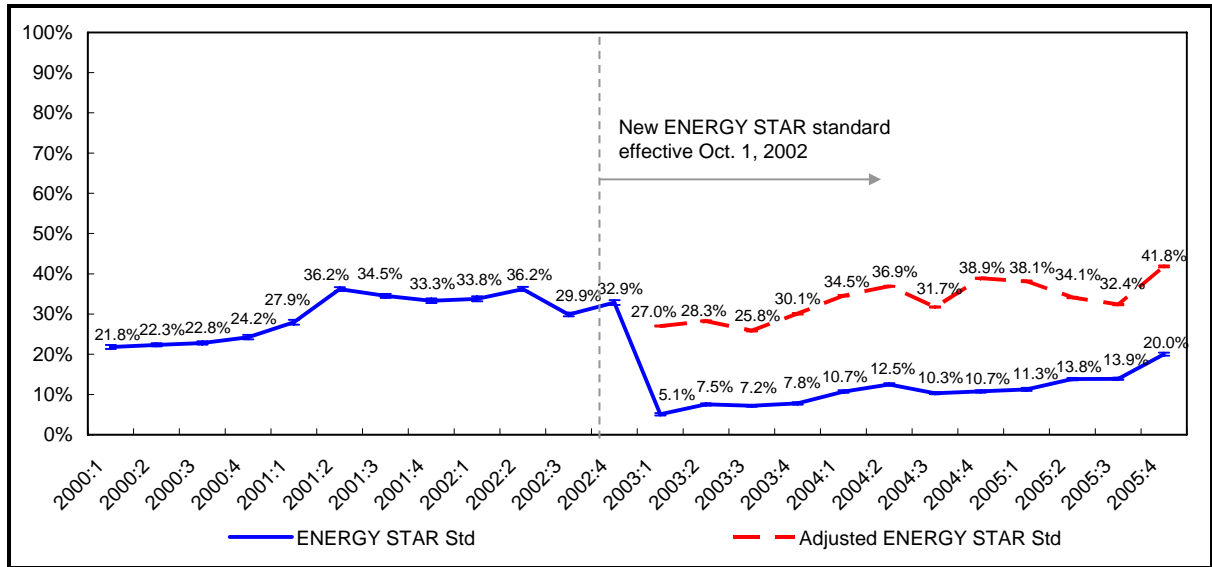


3.4. Market Share of ENERGY STAR Central Air Conditioners

Figure 3-2 presents the percentage of ENERGY STAR qualified CACs sold from 2000 through 2005 in California. As shown, the statewide share increased by roughly 50% (from 21.8% to 32.9%) between the first quarter of 2000 and the fourth quarter of 2002. The market share of ENERGY STAR qualified units decreased during 2003 because the ENERGY STAR specification increased from 12 to 13 SEER in October 2002. In this analysis, all 2002 CAC sales were based on the 12 SEER threshold for both split system and packaged units. Sales in 2003, however, were compared to the increased standard that took effect in October 2002. Thus, units sold after 2002 have been specified as split systems or packaged units. Because most of the CACs sold statewide are split systems, the change in specification greatly affected the ENERGY STAR share of CAC units. The share of ENERGY STAR qualified CACs sold in 2004 increased from 7.8% in the fourth quarter of 2003 to 10.7% in fourth quarter of 2004. The share of ENERGY STAR qualified CACs sold in 2005 increased from 11.3% in the first quarter of 2005 to 20.0% in the fourth quarter of 2005.

Figure 3-2 also illustrates the shares of ENERGY STAR qualified CAC units had the minimum standard not increased in 2002. Using the pre-2002 standard as a baseline reveals a slight increase in the share of ENERGY STAR units sold from 2003 to 2005. Using the pre-2002 standard, the ENERGY STAR market share for CACs actually peaked in the fourth quarter of 2005 at 41.8%.

Figure 3-2: Central Air Conditioner Sales, Percent of ENERGY STAR Qualified Units



Error bands for 90% confidence interval.

Dashed line denotes sales based upon the standard before the October 2002 specification change.

Table 3-3 illustrates state-level data for the market share of ENERGY STAR qualified CAC units both annually and by quarter. ENERGY STAR qualified CAC units had an average market share of 32.6% during 2002, but fell to 7.1% in 2003 because of the October 2002 ENERGY STAR standards change. Shares steadily increased to 14.8% in 2005, which was the highest annual market share since the 2002 standards revision.

Table 3-3: CAC Sales, Percent of ENERGY STAR Qualified Units (Statewide)

Year	Percent of ENERGY STAR Qualified CACs				
	Annual	Q1	Q2	Q3	Q4
2000	22.7% (.0014) n=90,369	21.8% (.0032) n=16,297	22.3% (.0024) n=30,078	22.8% (.0025) n=28,339	24.3% (.0034) n=15,655
2001	33.6% (.0016) n=89,150	28.0% (.0035) n=16,518	36.2% (.0029) n=27,245	34.5% (.0029) n=25,477	33.3% (.0033) n=19,910
2002	32.6% (.0016) n=87,209	33.8% (.0038) n=15,374	35.1% (.0030) n=24,844	29.9% (.0027) n=29,752	32.9% (.0036) n=17,239
2003	7.1% (.0008) n=100,284	5.1% (.0018) n=15,768	7.5% (.0016) n=26,962	7.2% (.0013) n=37,710	7.8% (.0019) n=19,844
2004	11.2% (.0008) n=138,681	10.7% (.002) n=24,265	12.5% (.002) n=43,084	10.3% (.002) n=41,967	10.8% (.0017) n=29,365
2005	14.8% (.0010) n=124,867	11.3% (.0022) n=19,901	13.8% (.0019) n=32,829	13.9% (.0017) n=43,832	20.0% (.0024) n=28,305

Standard errors in parentheses.

Figure 3-3 displays the market share of ENERGY STAR qualified CAC units at the utility-level. Figure 3-3 illustrates an increase in market share for each utility service area relative to 2004. PG&E exhibited the largest utility-wide increase in ENERGY STAR CAC market share, rising from 10.1% in 2004 to 17.7% in 2005. PG&E also exhibited the highest overall 2005 share at 17.7%, while the “Other” utility service area had the lowest share at 12.1%.

Figure 3-3: CAC Sales, Percent of ENERGY STAR Qualified Units by Utility Service Area

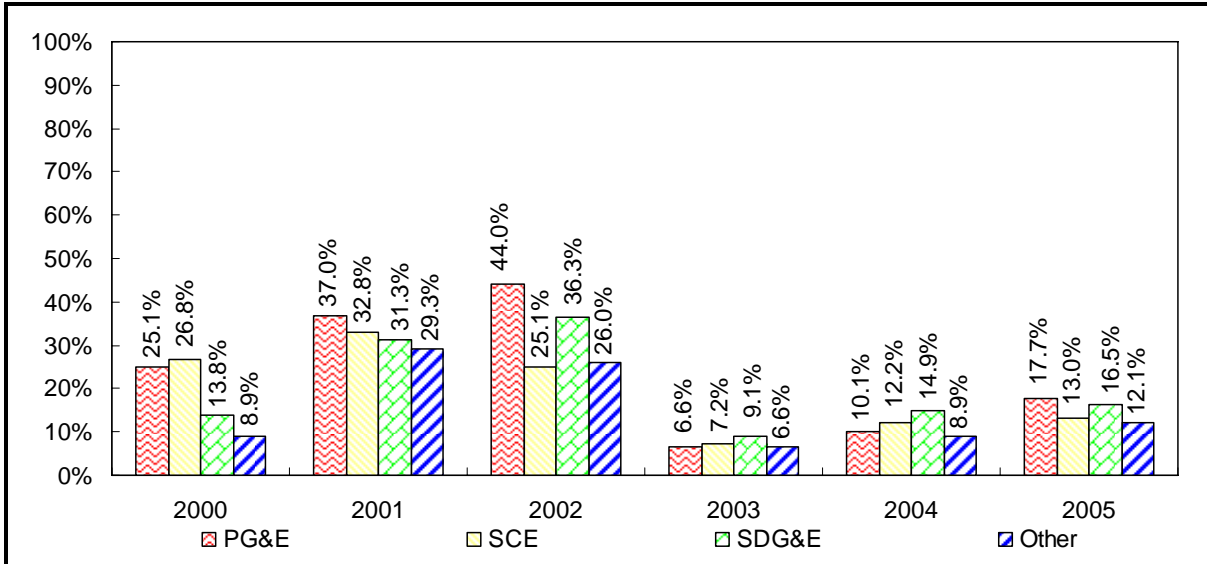


Table 3-4 presents utility-level ENERGY STAR market shares for CACs by year and quarter. Each utility’s share peaked in the fourth quarter of 2005, with PG&E exhibiting the highest quarterly level share of 26.5%. The utility service area labeled as “Other” had the lowest 2005 quarterly level share of 9.8%, which occurred in the second quarter.

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

Utility	Year	Percent of ENERGY STAR Qualified CACs ^{1,2}				
		Annual	Q1	Q2	Q3	Q4
PG&E	2000	25.1% (.0021) n=42,366	22.8% (.0051) n=6,807	23.8% (.0034) n=15,257	26.6% (.0039) n=12,770	27.5% (.0051) n=7,532
Southern California ³	2000	25.0% (.0021) n=42,362	24.6% (.0047) n=8,370	25.3% (.0038) n=12,901	25.5% (.0037) n=13,536	24.1% (.0049) n=7,555
Other	2000	8.9% (.0038) n=5,641	9.9% (.0089) n=1,120	9.5% (.0067) n=1,920	6.9% (.0056) n=2,033	12.3% (.0138) n=568
PG&E	2001	37.0% (.0024) n=39,837	29.1% (.0050) n=8,142	36.5% (.0042) n=13,024	41.1% (.0047) n=10,849	40.3% (.0055) n=7,822
Southern California ³	2001	32.6% (.0031) n=22,976	27.9% (.0071) n=3,956	37.3% (.0058) n=6,961	32.5% (.0056) n=7,102	30.2% (.0065) n=4,957
Other	2001	29.3% (.0028) n=26,337	25.1% (.0065) n=4,420	31.4% (.0054) n=7,260	28.5% (.0052) n=7,526	30.6% (.0055) n=7,131
PG&E	2002	44.0% (.0024) n=41,449	41.2% (.0059) n=7,034	47.2% (.0045) n=12,105	41.3% (.0041) n=14,152	46.3% (.0055) n=8,158
Southern California ³	2002	27.0% (.0029) n=22,714	30.8% (.0074) n=3,892	28.9% (.0058) n=6,182	24.5% (.0049) n=7,852	25.8% (.0063) n=4,788
Other	2002	26.0% (.0029) n=23,046	28.0% (.0067) n=4,448	26.9% (.0055) n=6,557	23.0% (.0048) n=7,748	28.1% (.0069) n=4,293
PG&E	2003	6.6% (.0014) n=30,654	5.2% (.0031) n=5,219	6.6% (.0026) n=8,974	6.9% (.0025) n=10,536	7.1% (.0033) n=5,925
Southern California ³	2003	7.6% (.0015) n=31,244	5.0% (.0033) n=4,433	8.9% (.0033) n=7,467	7.4% (.0023) n=13,032	8.5% (.0035) n=6,312
Other	2003	6.6% (.0013) n=38,386	5.2% (.0028) n=6,116	6.5% (.0024) n=10,521	7.0% (.0021) n=14,142	7.2% (.0030) n=7,607
PG&E	2004	10.1% (.0014) n=45,107	8.6% (.0031) n=8,018	11.5% (.0026) n=14,641	9.8% (.0027) n=12,016	9.7% (.0029) n=10,432
Southern California ³	2004	12.7% (.0015) n=48,242	13.1% (.0038) n=8,069	13.9% (.0028) n=14,955	11.5% (.0026) n=15,416	12.4% (.0033) n=9,802
Other	2004	8.9% (.0013) n=45,332	8.5% (.0031) n=8,178	10.7% (.0027) n=13,488	7.9% (.0022) n=14,535	8.2% (.0029) n=9,131
PG&E	2005	17.7% (.0020) n=35,783	12.1% (0.0041) n=6,350	15.8% (0.0036) n=10,299	17.1% (0.0034) n=11,970	26.5% (0.0052) n=7,164
Southern California ³	2005	13.6% (.0017) n=41,362	11.1% (0.0040) n=6,219	13.0% (0.0033) n=10,454	12.6% (0.0027) n=15,191	17.8% (0.0039) n=9,498
Other	2005	12.1% (.0015) n=47,722	9.8% (0.0035) n=7,332	11.5% (0.0029) n=12,076	11.8% (0.0025) n=16,671	14.8% (0.0033) n=11,643

1 Standard errors in parentheses.

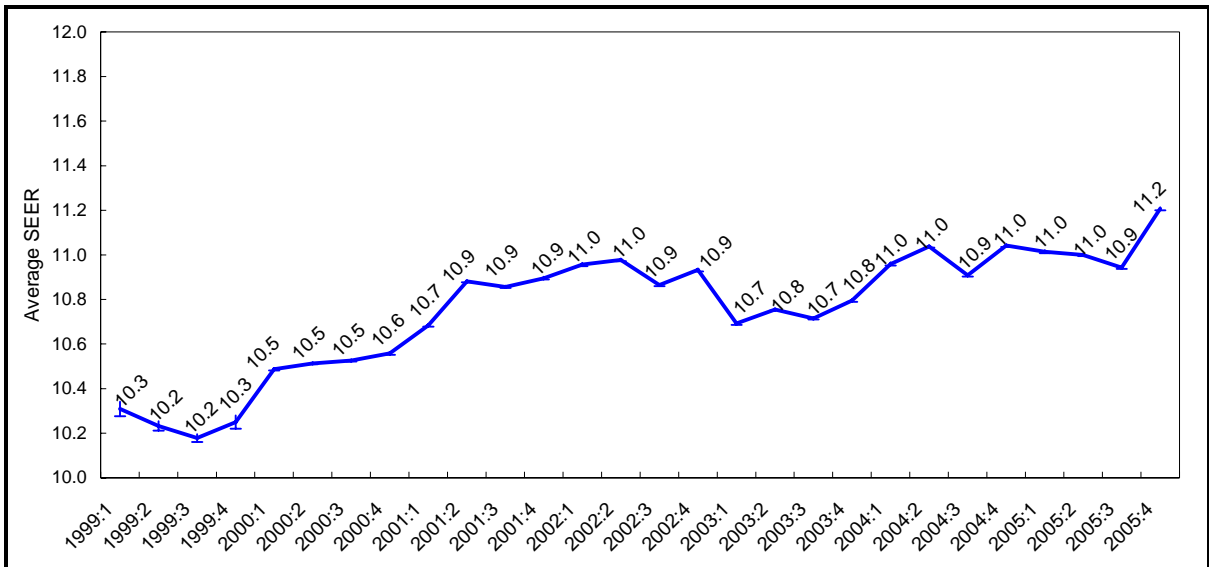
2 "Other" includes municipal utilities such as Los Angeles Department of Water and Power, Sacramento Municipal Utility District, and others.

3 Southern California is a combination of Southern California Edison, The Gas Company, and San Diego Gas & Electric.

3.5. Average SEER Efficiency of Central Air Conditioners in California

Figure 3-4 and Table 3-5 present the average SEER of CAC units sold in California from 1999 through 2005 by quarter. As shown, the average SEER ranged from a low of 10.2 during the third quarter of 1999 to a high of 11.2 in the fourth quarter of 2005. Many CAC units sold in 2003 were standard efficiency (10 SEER), which led to a reduction in the overall average SEER levels during that year. Additionally, the high SEER averages during 2001 and 2002 may be partially due to the energy crisis. The increase in average SEER in the fourth quarter of 2005 to 11.2 SEER is largely attributable to the growing market share of 13 SEER CAC units.

Figure 3-4: Central Air Conditioners, Average SEER by Quarter



Error bands for the 90% confidence interval.

Table 3-5: Central Air Conditioners, Average SEER by Quarter

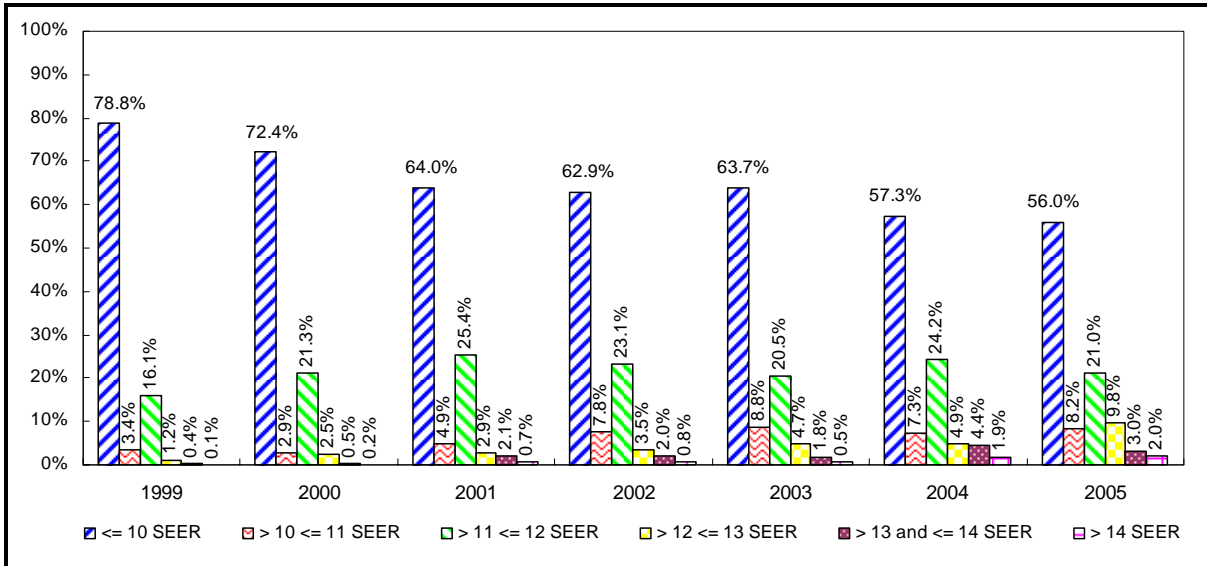
Year	Average SEER			
	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter
1999	10.3 (0.0196) n = 1,358	10.2 (0.0126) n = 2,589	10.2 (0.0105) n = 2,956	10.3 (0.0179) n = 1,360
2000	10.5 (0.0078) n = 16,231	10.5 (0.0056) n = 30,000	10.6 (0.0058) n = 28,243	10.6 (0.0080) n = 15,599
2001	10.7 (0.0039) n = 16,524	11.0 (0.0034) n = 27,259	10.9 (0.0034) n = 25,502	10.9 (0.0041) n = 19,949
2002	11.0 (0.0047) n=15,385	11.0 (0.0037) n=24,872	10.9 (0.0031) n=29,780	10.9 (0.0042) n=17,244
2003	10.7 (0.0036) n=15,771	10.8 (0.0029) n=26,963	10.7 (0.0023) n=37,710	10.8 (0.0034) n=19,848
2004	11.0 (0.0044) n=24,265	11.0 (0.0034) n=43,084	10.9 (0.0032) n=41,967	11.0 (0.0040) n=29,365
2005	11.0 (0.0044) n=19,901	11.0 (0.0036) n=32,829	10.9 (0.0029) n=43,832	11.2 (0.0041) n=28,305

Standard errors in parentheses.

Distribution of Central Air Conditioner Sales by SEER Efficiency Category

Figure 3-5 illustrates the distribution of CACs sold by SEER efficiency categories. These efficiency categories combine general efficiency groups. As shown, nearly 79% of units sold throughout 1999 were 10 SEER or less. In 2000, these percentages began to decline—fewer than three-fourths of all units sold were less than or equal to 10 SEER. This downward trend continued through 2002. Coincident with the decrease in lower efficiency units was a noticeable increase in the percentage of CAC sales between 11 and 12 SEER. These trends continued from 2001 through 2005 with generally decreasing percentages of 10 SEER units and increasing percentages of higher efficiency unit sales.

Figure 3-5: Central Air Conditioners, Percent of Sales by SEER Level



3.6. EER Analysis Methodology and Results

Model Matching

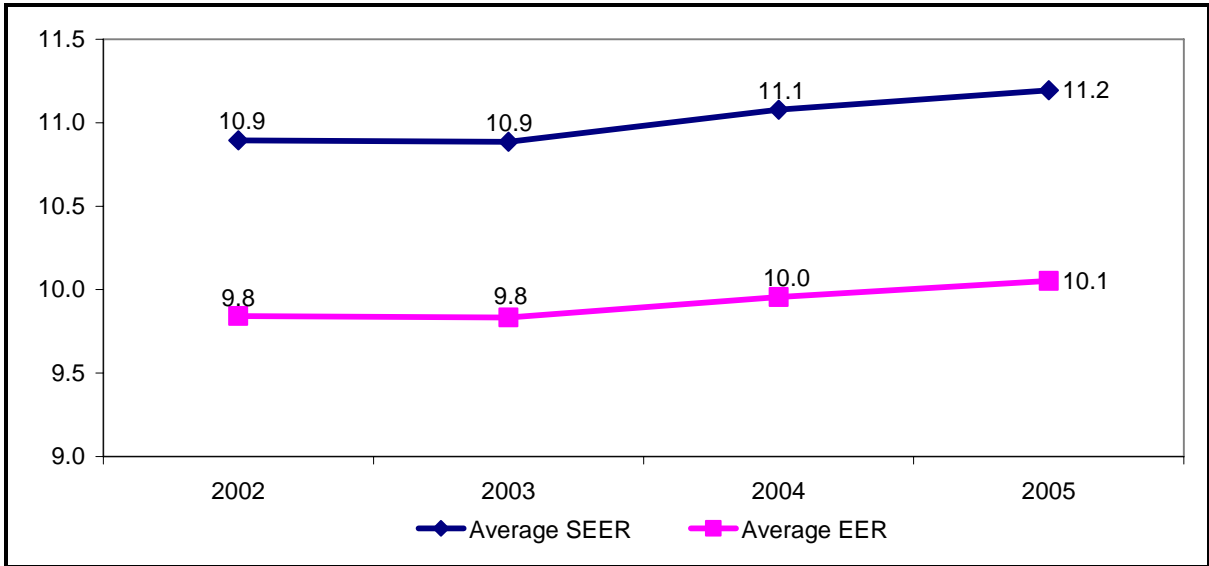
In order to analyze the relationship between SEER and EER in the current CAC market effectively, SEER and EER ratings were collected for model numbers contained in the RMST sales database from 2002 to 2005. SEER and EER ratings were matched to each model number by utilizing the CEC and ARI efficiency ratings databases, as well as individual manufacturer websites. EER ratings for CACs were not as readily available as SEER ratings, especially for the models sold in 2002. However, Itron was still able to obtain both SEER and EER for approximately 89% of the sales in the RMST database from 2002 to 2005.

During the model matching process, split system CACs were found to have a range of possible SEER and EER values for unique model numbers. Split system CACs consist of both an outdoor unit and an indoor cooling unit, but the model number in the RMST database represents only the outdoor unit. Therefore, there was no method to identify which indoor unit was paired along with the outdoor unit. For the purposes of the EER analysis, the average SEER and average EER were calculated based on all outdoor/indoor cooling unit combinations for each model number. Packaged CACs were not an issue, because the entire cooling system is comprised of one cooling unit. Therefore, there is only one SEER rating and one EER rating for each model. After efficiency information was collected for each model, each observation was then weighted by the quantity sold in order to reflect the market share of each model.

Average Efficiency of Central Air Conditioners in California

Figure 3-6 presents the average SEER and EER of CAC units sold in California from 2002 through 2005 by year. As shown, the average SEER rose steadily between 2002 and 2005, peaking at 11.2 SEER in 2005. Similarly, the average EER rose from 9.8 to 10.1 during the same period.

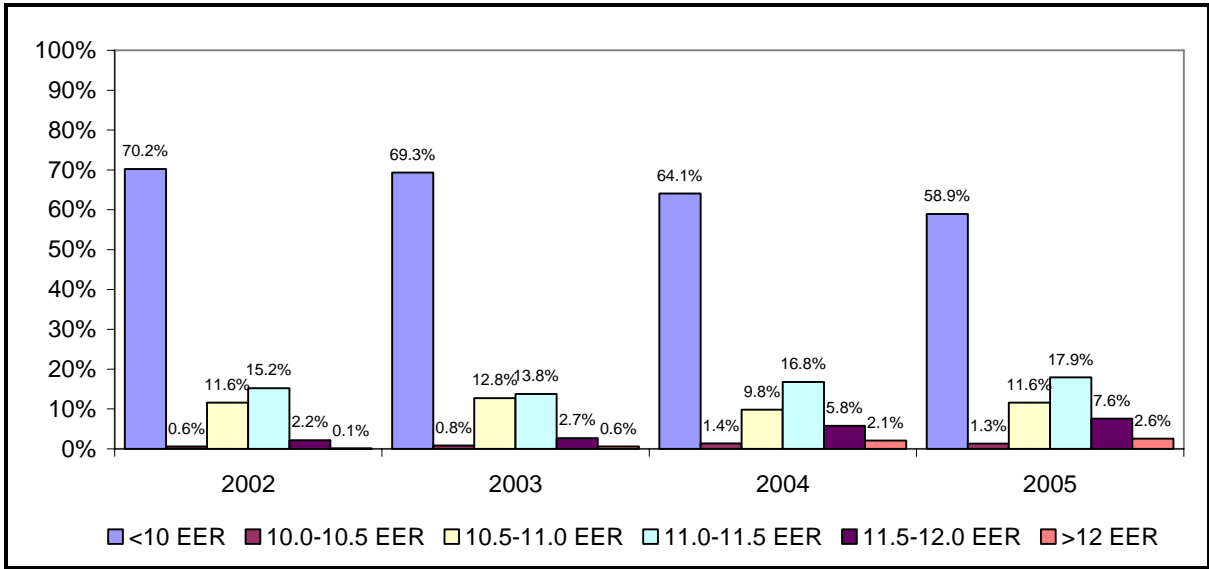
Figure 3-6: Central Air Conditioners, Average SEER and EER by Year



Distribution of Central Air Conditioner Sales by Efficiency Category

Figure 3-7 illustrates the distribution of CACs sold by EER efficiency categories. As shown, the percentage of CACs with efficiency ratings of at least 11 EER, have increased slightly from 17.5% in 2002 to 28.1% in 2005. The percentage of air conditioners sold in the highest efficiency category (> 12 EER) also increased from 0.1% to 2.6% between 2002 and 2005.

Figure 3-7: Central Air Conditioners, Percent of Sales by EER Level



Distribution of SEER and EER Ratings for Central Air Conditioners

Figure 3-8 presents a scatter plot of SEER versus EER for all CACs included in the RMST HVAC databases from 2002-2005. As shown, the EER values for a given SEER vary drastically. For example, EERs found for 13 SEER air conditioners range from just over 10 EER to 12.5 EER with most falling between 11.5 and 12.1 EER. The trend lines illustrate that as the SEER increases, the difference between the estimated EER and the actual EER tends to increase also. The graph also illustrates that it is possible to have an 11 SEER air conditioner with a higher EER rating than some 13 SEER units.

Figure 3-8: SEER vs. EER Distribution for Central Air Conditioners

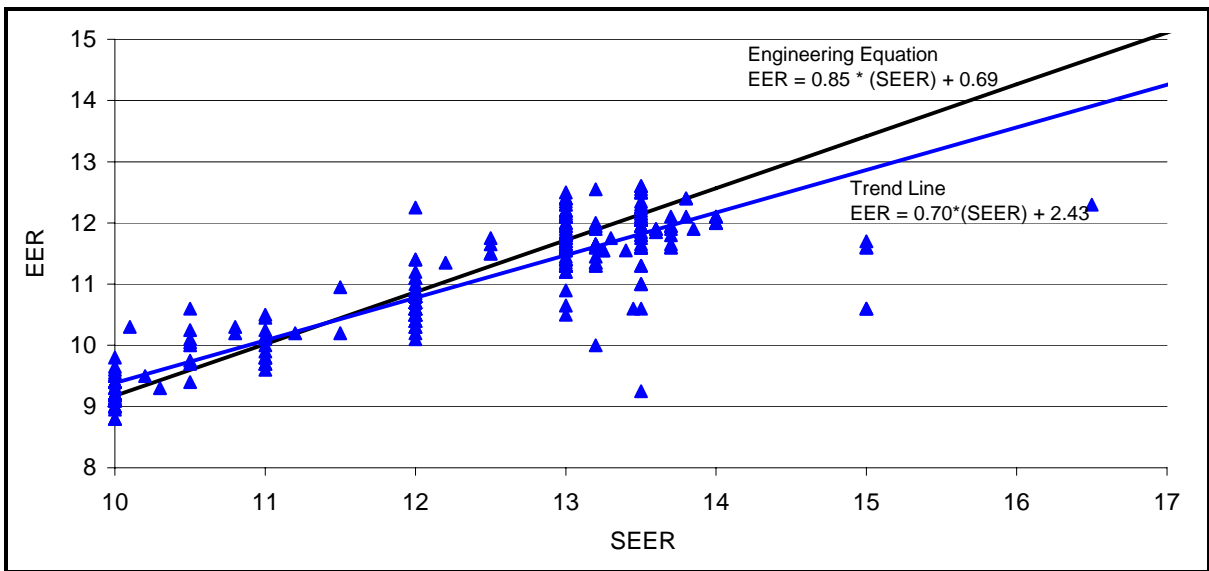
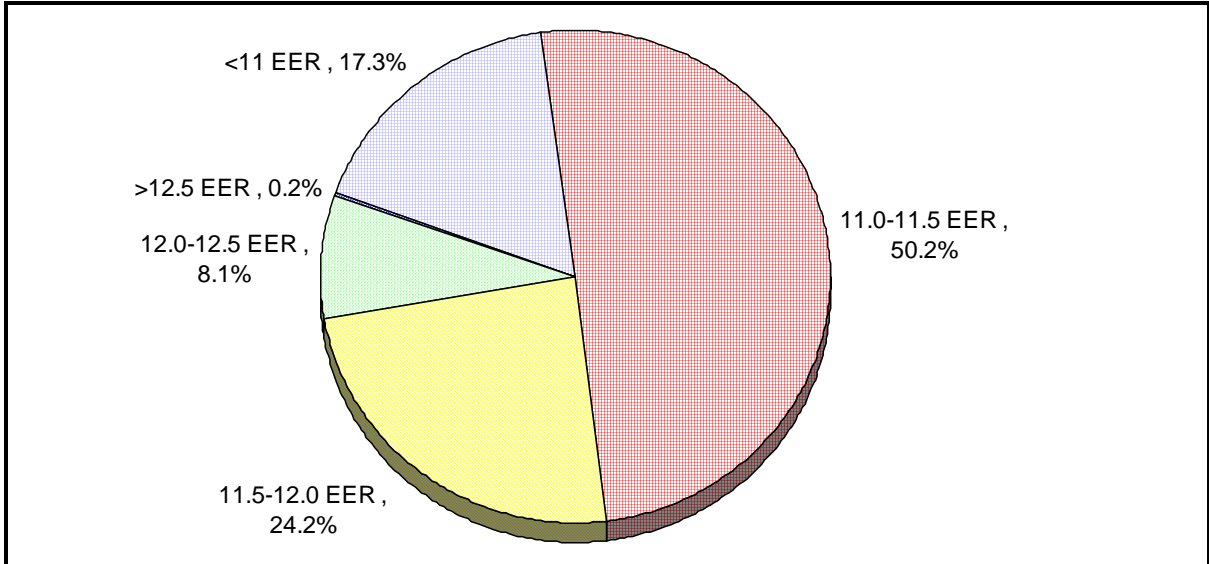


Figure 3-9 displays EER categories of CACs sold in 2005 that were at least 12.5 SEER or more efficient. As shown, nearly half of these units were between 11.0 and 11.5 EER. Just over 8% of these CACs had an efficiency rating greater than 12.0 EER.

Figure 3-9: Distribution of Central Air Conditioners (>12.5 SEER) by EER Level (% of Sales)



4

Heat Pumps

4.1. Overview

This section presents the efficiency market shares and average efficiencies of air-source heat pumps purchased in California's residential sector. Subsection 4.2 summarizes energy efficiency standards for heat pumps and Subsection 4.3 includes estimates of residential HP sales in California. Subsection 4.4 presents estimates of the share of ENERGY STAR qualified heat pumps in the California market. Subsection 4.5 presents estimates of average efficiencies in the overall California market.

4.2. Heat Pump Efficiency Standards

Air-source heat pumps have both cooling and heating efficiency ratings. Similar to CACs, cooling efficiency is expressed as SEER value. Heat pump heating efficiency ratings are expressed as a Heating Seasonal Performance Factor (HSPF). As with SEER, the higher the HSPF, the more efficiently the heat pump performs.

Table 4-1 provides a summary of federal, state, and ENERGY STAR minimum efficiency standards for heat pumps. As of January 23, 2006, the new minimum federal standard efficiency for heat pumps is 13 SEER/7.7 HSPF for both split and package systems. The revised standards result in a 30% increase in minimum SEER and a 13% increase in the minimum HSPF rating of split system heat pumps (for packaged units these values are 34% and 17%, respectively).²⁵

The CEC has also published the same increases to the appliance energy efficiency standards for air-source heat pump units. This action is part of the continual evaluation of state appliance standards, which occurs to comply with the California Energy Security and Reliability Act of 2000.

ENERGY STAR program requirements for heat pumps were also revised and new standards became effective on April 1, 2006. Under the new standards, heat pumps must have an efficiency rating of at least 14 SEER/11.5 EER/8.2 HSPF for split systems and 14 SEER/11

²⁵ DOE. *Federal Register. Central Air Conditioners and Heat Pumps.* 10 CFR Part 430.

EER/8 HSPF/ for single systems.²⁶ A second phase, effective on January 1, 2009, will further increase the qualifying requirements to 14.5 SEER/12 EER/8.2 HSPF for split systems.

Note that the heat pump sales data presented in the current report were analyzed under the ENERGY STAR standard that was in effect from October 2002 to December 2005, because the current report only addresses sales data and efficiency trends through 2005. To qualify for the ENERGY STAR label from October 2002 to December 2005, heat pumps must have been at least 13 SEER/11 EER/8.0 HSPF for a split system and 12 SEER/10.5 EER/7.6 HSPF for a packaged unit. The analysis of 2006 sales data in next year's report will account for the 2006 ENERGY STAR standard.

Table 4-1: Comparison of Federal and ENERGY STAR Heat Pump Standards

	Split Systems (SEER)	Split Systems (EER)	Split Systems (HSPF)	Single Package Equipment (SEER)	Single Package Equipment (EER)	Single Package Equipment (HSPF)
Federal						
1992 Standard	10	n/a	6.8	9.7	n/a	6.6
Current/2006 Standard	13	n/a	7.7	13	n/a	7.7
Percent Improved	30%	n/a	9%	34%	n/a	12%
ENERGY STAR						
2002 Standard	13	11	8.0	12	10.5	7.6
Current/2006 Standard (Tier 1)	14	11.5	8.2	14	11	8
January 1, 2009 Standard (Tier 2)	14.5	12	8.2	14	11	8
California Standard						
1995 Standard	10	n/a	6.8	9.7	n/a	6.6
Current/2006 Standard	13	n/a	7.7	13	n/a	7.7

*The percent improvement listed reflects the change in SEER/HSPF rating, not the decrease in energy usage.

²⁶ Energy Star Program Requirements for Air Source Heat Pumps (ASHP) and Central Air Conditioner Equipment. Eligibility Criteria. Version 4.0. (See http://www.energystar.gov/index.cfm?c=revisions.revisions_specs).

4.3. Total Unit Sales

Table 4-2 presents estimates of total unit sales for residential heat pumps. As with CACs, there is no publicly available definitive source for data regarding annual unit sales, or sales by decision type for heat pumps. These figures were developed through a process that examined the total number of households in California and the quantity of homes newly constructed.²⁷ Both the statewide and new construction data were scaled to estimate California’s annual sales based on number of households and updated measure type saturations. The life expectancy of heat pumps was also taken into consideration when developing unit sales for California.²⁸

Table 4-2: Estimates of California’s Annual Heat Pump Sales

Year	Total Unit Sales
2000	82,500
2001	88,000
2002	90,000
2003	102,000
2004	115,000
2005	130,000

Total unit sales data developed from information provided by ARI, Appliance Magazine, EPRI 1998, and compared with information on life expectancies and saturations.

4.4. Market Share of ENERGY STAR Heat Pumps

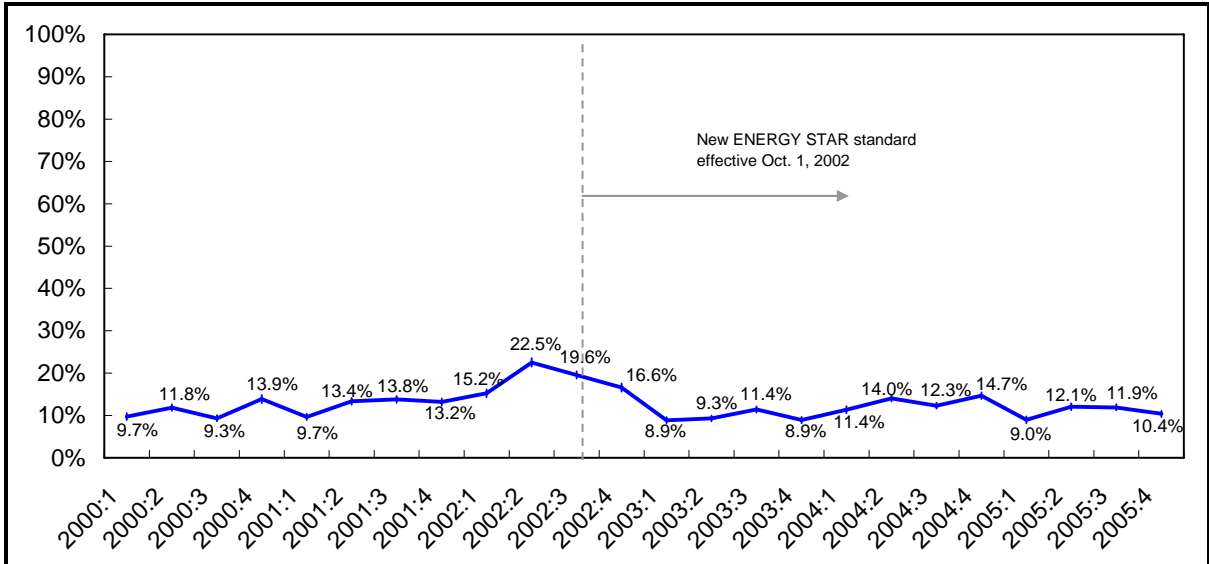
Figure 4-1 and Table 4-3 present the quarterly percentages of ENERGY STAR qualified heat pumps sold in California from 2000 through 2005. Before 2003, the statewide market share of ENERGY STAR qualified heat pumps ranged from a low of 9.3% in the third quarter of 2000 to high of 22.5% in the second quarter of 2002. As with CACs, the ENERGY STAR specification for heat pumps increased during the fourth quarter of 2002. As a result, the first quarter of 2003 showed a decline to 8.9%, the lowest share seen during the period examined. It is important to understand that the average efficiency of units sold in 2003 exceeded the average efficiency of units sold prior to 2002, even though the ENERGY STAR market share

²⁷ Number of households from the U.S. Census. For estimates of new construction see: RER, Inc. September 2002. *Residential New Construction Study – Year #2*. Prepared for Pacific Gas & Electric Company.

²⁸ Appliance Magazine. “A Portrait of the U.S. Appliance Industry: The Saturation Picture; The Share-of-Market Picture; The Life Expectancy/Replacement Picture; Who’s Who in the Appliance Industry.” September 1998. pp. 68-90.

decreased in 2003.²⁹ By the fourth quarter of 2004, the market share of ENERGY STAR qualified heat pumps increased to 14.7%. The market share decrease of ENERGY STAR qualified heat pumps to 10.4% in the fourth quarter of 2005 can be attributed to the loss of a vendor who sold high efficiency heat pumps.

Figure 4-1: Heat Pump Sales, Percent of ENERGY STAR Qualified Units



Error bands for the 90% confidence interval.

²⁹ Refer to Figure 4-2: Heat Pumps, Average Cooling Efficiency (SEER).

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

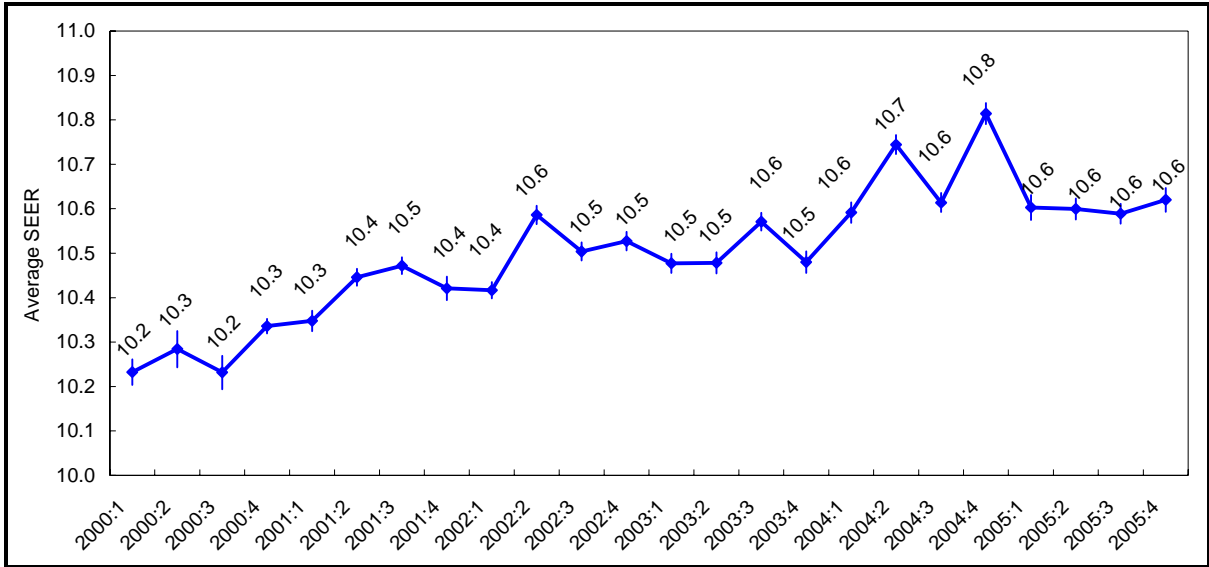
Year	Percent of ENERGY STAR Qualified Heat Pumps				
	Annual	Q1	Q2	Q3	Q4
2000	11.1% (.0025) n=16,154	9.7% (.0051) n=3,356	11.8% (.0047) n=4,789	9.3% (.0043) n=4,566	13.9% (.0059) n=3,443
2001	12.6% (.0024) n=19,136	9.7% (.0044) n=4,565	13.4% (.0049) n=4,864	13.8% (.0048) n=5,077	13.2% (.0050) n=4,630
2002	18.7% (.0029) n=18,515	15.2% (.0055) n=4,273	22.5% (.0062) n=4,566	19.6% (.0053) n=5,664	16.6% (.0059) n=4,012
2003	9.7% (.0022) n=18,413	8.9% (.0044) n=4,114	9.3% (.0041) n=4,990	11.4% (.0044) n=5,317	8.9% (.0045) n=3,992
2004	13.2% (.0023) n=21,427	11.4% (.0048) n=4,401	14.0% (.0046) n=5,815	12.3% (.0042) n=6,030	14.7% (.0049) n=5,241
2005	11.0% (.0023) n=18,550	9.0% (.0048) n=3,554	12.1% (.0049) n=4,364	11.9% (.0044) n=5,443	10.4% (.0042) n=5,189

Standard errors in parentheses.

4.5. Average Cooling Efficiency of Heat Pumps in California

Figure 4-2 and Table 4-4 present the average cooling efficiency ratings (SEER) of heat pumps sold in California from 2000 through 2005, by quarter. As shown, the average SEER ranged from a low of 10.2 in the first and third quarters of 2000 to a high of 10.8 during in the fourth quarter of 2004. The average SEER decreased to 10.6 during 2005, again because of losing a vendor who sold predominantly higher efficiency equipment.

Figure 4-2: Heat Pumps, Average Cooling Efficiency (SEER)



Error bands for the 90% confidence interval.

Table 4-4: Heat Pumps, Average Cooling Efficiency (SEER)

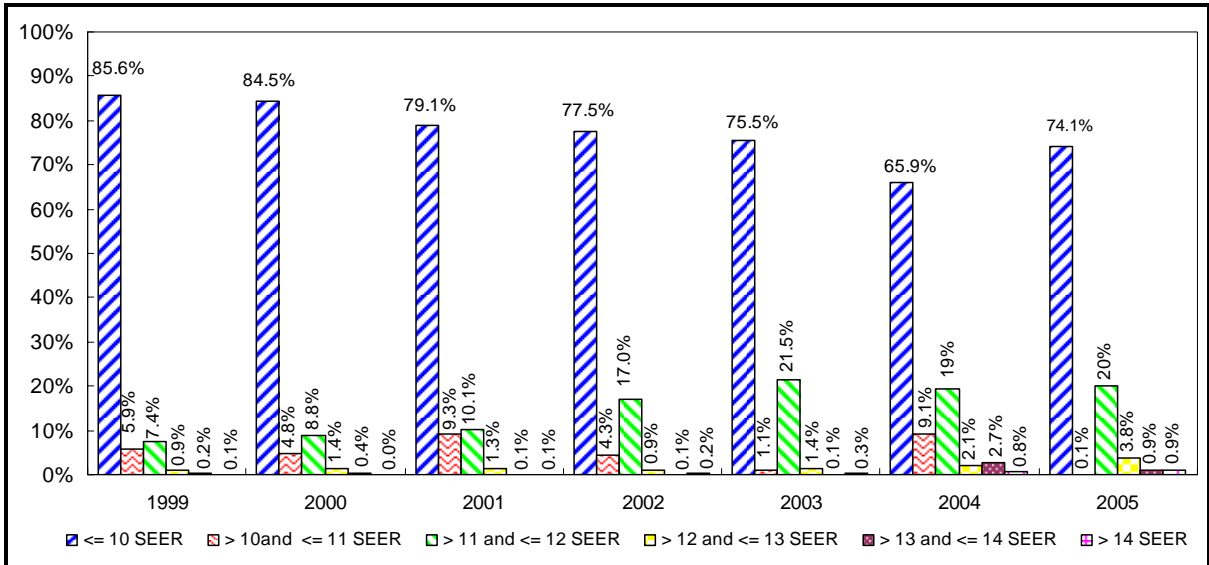
Year	Average SEER			
	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter
1999	10.1 (0.0176) n = 535	10.3 (0.0249) n = 723	10.3 (0.0229) n = 896	10.0 (0.0099) n = 894
2000	10.2 (0.0141) n = 3,268	10.3 (0.0116) n = 4,721	10.2 (0.0115) n = 4,487	10.3 (0.0162) n = 3,385
2001	10.4 (0.0112) n = 4,569	10.5 (0.0125) n = 4,873	10.5 (0.0125) n = 5,094	10.4 (0.0127) n = 4,634
2002	10.4 (0.0132) n = 4,279	10.6 (0.0145) n = 4,584	10.5 (0.0123) n = 5,720	10.5 (0.0149) n = 4,032
2003	10.5 (0.0140) n = 4,120	10.5 (0.0130) n = 4,990	10.6 (0.0130) n = 5,319	10.5 (0.0145) n = 3,992
2004	10.6 (0.0172) n = 4,401	10.7 (0.0144) n = 5,815	10.6 (0.0136) n = 6,030	10.8 (0.0163) n = 5,241
2005	10.6 (0.0179) n = 3,554	10.6 (0.0171) n = 4,364	10.6 (0.0145) n = 5,443	10.6 (0.0152) n = 5,189

Standard errors in parentheses.

Distribution of Heat Pump Sales by Cooling Efficiency Category

Figure 4-3 illustrates the distribution of heat pumps sold by SEER level. As shown, the percentage of units 10 SEER or less has decreased slightly from 85.6% in 1999 to 74.1% in 2005. This decrease appears to have been offset by an increase in the percent of 11 to 12 SEER units. Sales of units with SEER greater than 12 have been minimal from 2000 to 2005.

Figure 4-3: Heat Pumps, Percent of Sales by SEER Level



5

Central Gas Furnaces

5.1. Overview

This section presents the efficiency market shares and average efficiencies of central gas furnaces purchased for use in California's residential sector. Subsection 5.2 summarizes energy efficiency standards for gas furnaces. Subsection 5.3 includes estimates of total gas furnace sales in California by decision type. Subsection 5.4 presents estimates of ENERGY STAR market share for furnaces. Subsection 5.5 presents average furnace efficiencies and the distribution of furnace sales by efficiency category.

5.2. Furnace Efficiency Standards

The energy efficiency of furnaces is expressed as a percentage of Annual Fuel Utilization Efficiency (AFUE). Equipment AFUE levels increase as energy efficiency increases. The federal minimum AFUE standard for furnaces is 78%.^{30,31} California's standards for furnaces set by the CEC match the federal standard. Currently, there are no anticipated changes to the federal or state standards.

Units must have at least a 90% AFUE to qualify for the ENERGY STAR label. The ENERGY STAR program is currently evaluating its existing standard for furnaces, though no changes have been proposed to date.

³⁰ DOE. *Federal Register. Central Air Conditioners and Heat Pumps*. Title 10, Chapter II, Subpart C, Part 430, Section 430.32.

³¹ Required efficiency for residential central gas furnaces that are less than 225 kBtu/hr.

5.3. Total Unit Sales, New Construction Installations, and Retrofit, Replacement, and Net Acquisition Estimates

Table 5-1 presents estimated central gas furnace unit sales from 1999 through 2005. Itron developed the 1999 figures by examining national shipment data from Appliance Magazine and subsequently cross-referencing that information with the CEC.³² The 2000 through 2005 data were developed through a process that examined the total number of households, new housing starts in California, and residential new construction on-site survey data.³³ Both the statewide and new construction data were scaled to estimate California’s annual sales based on the number of households and updated measure saturations. Retrofit/replacement units are then estimated as the difference between total units sold and units for new construction. Currently, there is no publicly available definitive source of annual unit sales at the state level, nor is there information that indicates whether units sold or shipped would be installed as retrofit/replacement units or in new construction.

Table 5-1: Estimates of Annual Central Gas Furnaces Sales by Decision Type

Year	Total Units Sales	New Construction	Retrofit/ Replacement
1999	413,400	102,800	310,600
2000	408,600	115,400	293,200
2001	415,000	113,000	302,000
2002	418,800	116,800	302,000
2003	562,500	160,100	402,400
2004	564,000	161,800	402,200
2005	578,000	175,600	402,400

³² See: http://www.appliancemagazine.com/mm/stats/html/december_1999.html, <http://www.ari.org/sr/1999/sr9912.pdf>, and

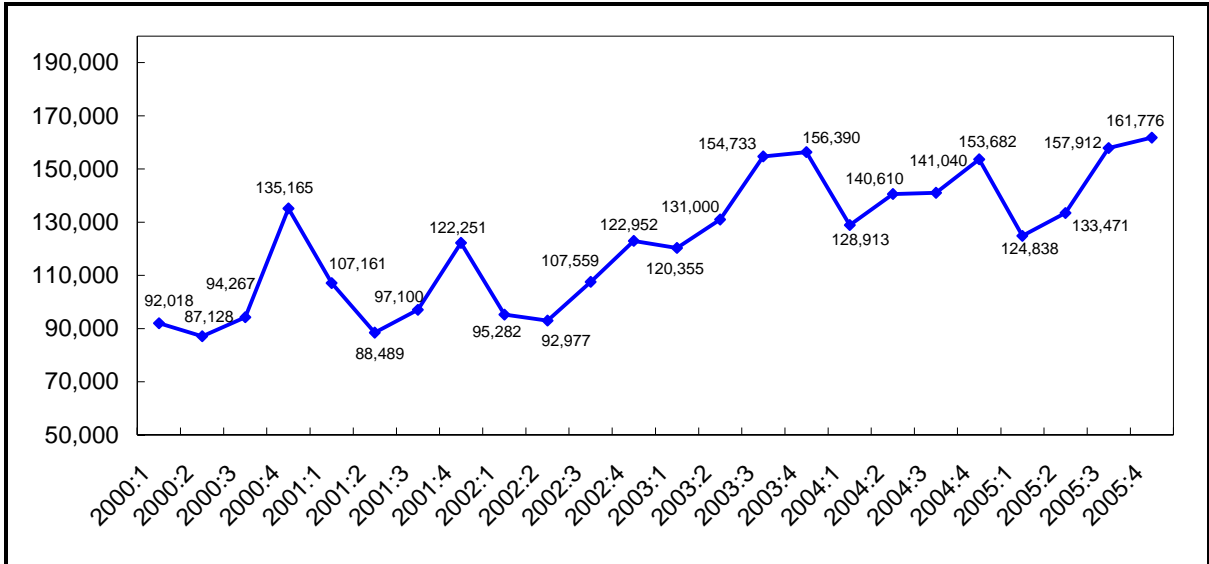
California Energy Commission. July 1995. *Staff Report California Energy Demand: 1995-2015*.

³³ Number of households from the U.S. Census. For estimates of new construction see:

RER, Inc. September 2002. *Residential New Construction Study – Year #2*. Prepared for Pacific Gas & Electric Company.

Figure 5-1 illustrates estimated quarterly sales for gas furnaces since the first quarter of 2000. Itron developed these data from utility service area weighted sales data obtained from the RMST furnace distributor panel. Sales in California reflect some seasonality, with increases during the fourth quarter and decreases in second quarter of each year.³⁴

Figure 5-1: Estimated California Gas Furnace Quarterly Sales

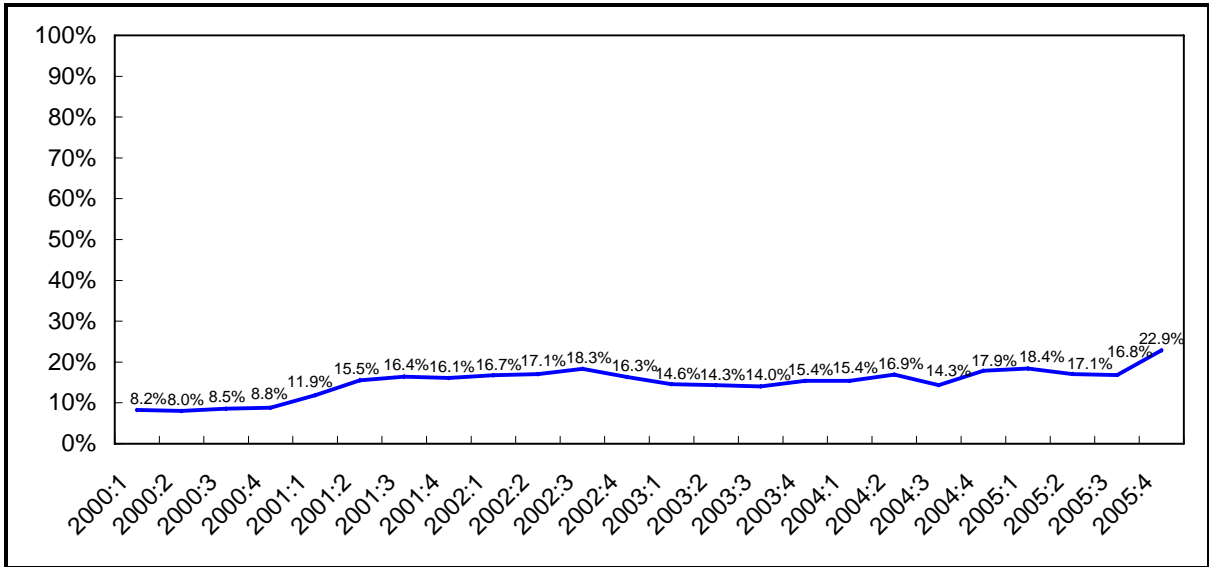


5.4. Market Share of ENERGY STAR Gas Furnaces

Figure 5-2 and Table 5-2 present the statewide percentage of ENERGY STAR qualified gas furnaces sold by quarter from 2000 through 2005. As shown, the statewide market share of ENERGY STAR qualified gas furnaces ranges from a low of 8.0% in the second quarter of 2000 to a high of 22.9% in the fourth quarter of 2005. The increasing market share of ENERGY STAR furnaces in 2005 can be attributed to the growing sales of 92 AFUE furnaces.

³⁴ Figure 5-1 does not correspond to Table 5-1 because they were developed using different sales data (publicly available shipment data versus the distributor panel sales data).

Figure 5-2: Central Gas Furnace Sales, Percent of ENERGY STAR Qualified Units



Error bands for 90% confidence interval.

Table 5-2: Gas Furnace Sales, Percent of ENERGY STAR Qualified Units (Statewide)

Year	Percent of ENERGY STAR Qualified Gas Furnaces				
	Annual	Q1	Q2	Q3	Q4
2000	8.5% (.0009) n=88,309	8.2% (.0020) n=19,854	8.0% (.0020) n=19,207	8.5% (.0019) n=21,052	8.8% (.0017) n=28,196
2001	15.0% (.0010) n=117,053	11.9% (.0018) n=29,978	15.5% (.0023) n=25,145	16.4% (.0022) n=27,291	16.1% (.0020) n=34,639
2002	17.1% (.0011) n=127,572	16.7% (.0022) n=30,007	17.1% (.0022) n=29,302	18.3% (.0021) n=32,508	16.3% (.0020) n=35,755
2003	14.6% (.0010) n=129,462	14.6% (.0021) n=27,686	14.3% (.0020) n=30,400	14.0% (.0018) n=35,741	15.4% (.0019) n=35,635
2004	16.2% (.0009) n=157,878	15.4% (.0019) n=35,678	17.0% (.0019) n=39,819	14.3% (.0018) n=40,102	17.9% (.0019) n=42,189
2005	18.9% (.0010) n=153,182	18.4% (.0021) n=32,599	17.1% (.0020) n=35,827	16.8% (.0018) n=42,303	22.9% (.0020) n=42,453

Standard errors in parentheses.

Figure 5-3 and Table 5-3 present utility-level data for the market share of ENERGY STAR qualified furnace units. Figure 5-3 illustrates that the largest increase in ENERGY STAR share occurred for SDG&E, whose share increased from 10.6% in 2004 to 18.1% in 2005. PG&E exhibited the highest overall ENERGY STAR market share for furnaces at 25.9%, while SCE had the lowest share at 11.4%. Table 5-3 presents utility-level data for the market share of ENERGY STAR qualified furnace units by year and by quarter. Each utility's share peaked in the fourth quarter of 2005, with PG&E exhibiting the highest quarterly share of 28.6%.

Figure 5-3: Central Gas Furnace Sales, Percent of ENERGY STAR Qualified Units by Utility Service Area

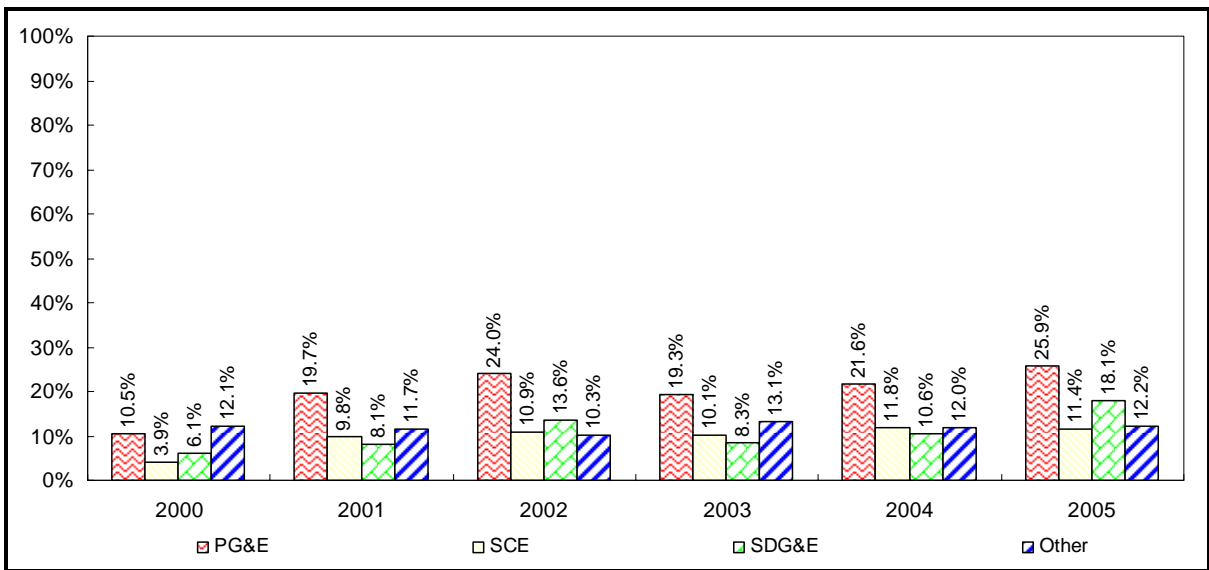


Table 5-3: Gas Furnace Sales, Percent of ENERGY STAR Qualified Units by Utility Service Area

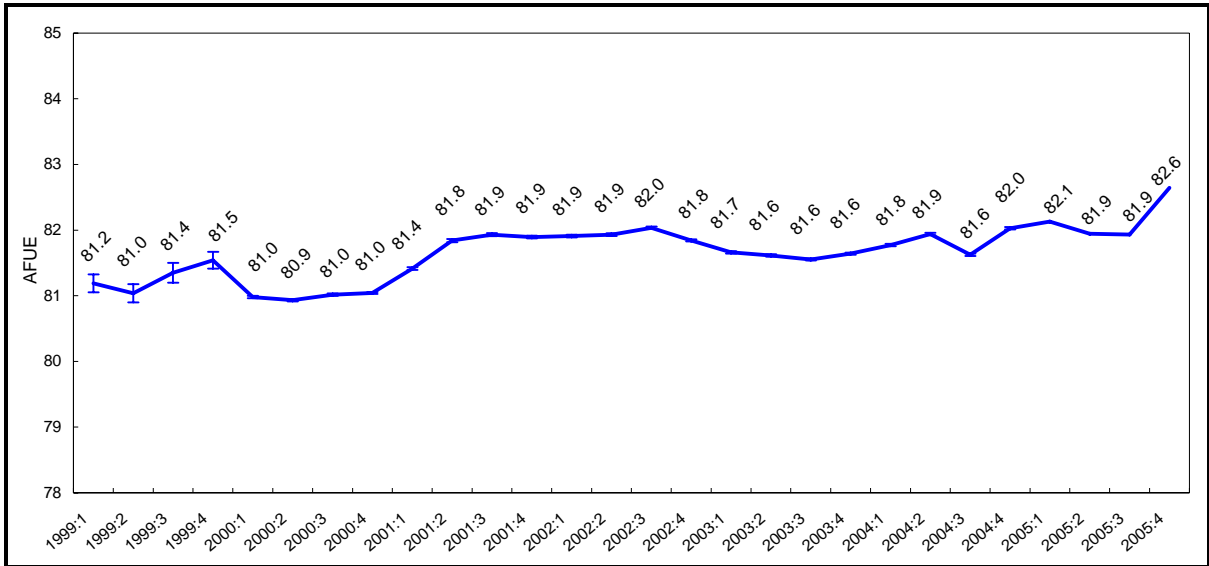
Utility	Year	Percent of ENERGY STAR Qualified Furnaces ^{1,2}				
		Annual	Q1	Q2	Q3	Q4
PG&E	2000	10.5% (.0012) n=59,874	9.4% (.0025) n=13,598	9.3% (.0025) n=13,589	10.8% (.0025) n=14,865	11.91% (.0024) n=17,822
Southern California ³	2000	4.5% (.0013) n=23,639	4.7% (.0029) n=5,196	4.2% (.0029) n=4,668	4.4% (.0028) n=5,228	4.8% (.0023) n=8,547
Other	2000	12.1% (.0047) n=4,796	14.3% (.0107) n=1,060	14.0% (.0113) n=950	10.9% (.0100) n=959	10.5% (.0072) n=1,827
PG&E	2001	19.7% (.0016) n=61,409	16.8% (.0030) n=15,807	20.0% (.0035) n=13,254	21.9% (.0035) n=14,316	20.4% (.0030) n=18,032
Southern California ³	2001	9.3% (.0016) n=31,247	5.9% (.0026) n=8,150	10.4% (.0038) n=6,614	9.8% (.0035) n=7,041	11.0% (.0032) n=9,442
Other	2001	11.7% (.0021) n=24,397	9.1% (.0037) n=6,021	11.6% (.0044) n=5,277	12.2% (.0042) n=5,934	13.4% (.0040) n=7,165
PG&E	2002	24.0% (.0016) n=68,037	21.3% (.0033) n=15,800	22.9% (.0034) n=15,664	27.2% (.0034) n=17,124	24.3% (.0031) n=19,449
Southern California ³	2002	11.6% (.0018) n=33,215	13.8% (.0039) n=7,683	12.4% (.0037) n=7,817	11.2% (.0034) n=8,401	9.5% (.0030) n=9,314
Other	2002	10.3% (.0019) n=26,320	10.3% (.0038) n=6,524	11.3% (.0042) n=5,821	10.6% (.0037) n=6,983	9.2% (.0035) n=6,992
PG&E	2003	19.3% (.0017) n=51,345	18.1% (.0035) n=12,082	19.0% (.0037) n=11,364	18.3% (.0033) n=13,376	21.4% (.0034) n=14,523
Southern California ³	2003	9.5% (.0015) n=38,459	9.9% (.0035) n=7,154	10.3% (.0032) n=8,822	9.4% (.0028) n=11,132	8.9% (.0027) n=11,351
Other	2003	13.1% (.0017) n=39,658	13.4% (.0037) n=8,450	12.0% (.0032) n=10,214	13.6% (.0032) n=11,233	13.4% (.0035) n=9,761
PG&E	2004	21.63% (.0017) n=55,736	19.24% (.0034) n=13,371	23.79% (.0037) n=13,138	20.14% (.0035) n=12,927	23.04% (.0033) n=16,300
Southern California ³	2004	11.42% (.0013) n=56,615	11.62% (.0029) n=11,965	11.84% (.0027) n=14,777	9.56% (.0024) n=14,855	12.68% (.0027) n=15,018
Other	2004	12.0% (.0015) n=45,527	12.2% (.0032) n=10,432	11.7% (.0029) n=11,904	10.9% (.0028) n=12,320	13.3% (.0033) n=10,871
PG&E	2005	25.9% (.0018) n=58,105	25.1% (.0037) n=13,488	24.4% (.0038) n=12,831	25.0% (.0035) n=14,902	28.6% (.0035) n=16,884
Southern California ³	2005	13.6% (.0016) n=48,487	11.8% (.0032) n=10,004	12.0% (.0030) n=11,421	11.2% (.0027) n=13,832	18.8% (.0034) n=13,230
Other	2005	12.2% (.0015) n=46,590	12.5% (.0035) n=9,107	10.6% (.0029) n=11,575	9.9% (.0026) n=13,569	16.0% (.0033) n=12,339

1. Standard errors in parentheses.
2. "Other" includes municipal utilities such as LADWP, LMUD, PP&L, SMUD, and others.
3. Southern California is a combination of SCE, The Gas Company, and SDG&E.

5.5. Average Efficiencies of Gas Furnaces in California

Figure 5-4 and Table 5-4 present the average AFUE of central gas furnaces sold in California by quarter from 1999 through 2005. The trend has remained steady over the past few years. As shown, the average AFUE ranged from a low of 80.9 in the second quarter of 2000 to a high of 82.6 during the fourth quarter of 2005.

Figure 5-4: Central Gas Furnaces, Average AFUE



Error bands for the 90% confidence interval.

Table 5-4: Central Gas Furnaces, Average AFUE

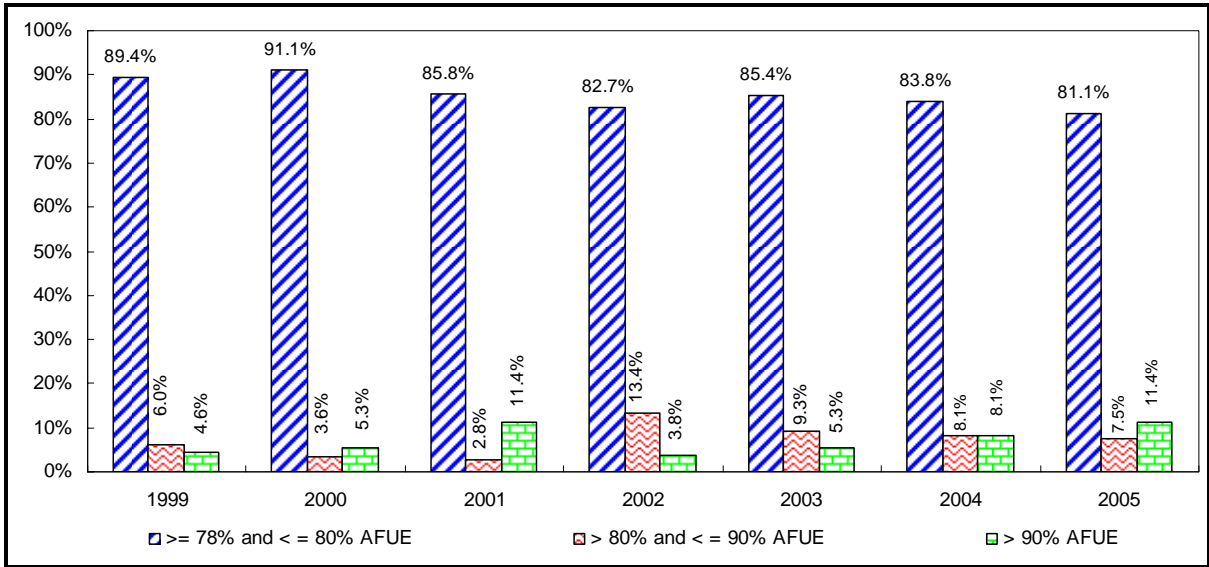
Year	Average AFUE			
	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter
1999	81.2 (0.0821) n = 1,556	81.0 (0.0846) n = 1,300	81.4 (0.0909) n = 1,414	81.5 (0.0780) n = 2,147
2000	81.0 (0.0240) n = 19,755	81.0 (0.0235) n = 19,207	81.1 (0.0241) n = 21,049	81.1 (0.0211) n = 28,195
2001	81.4 (0.0119) n = 30,014	81.8 (0.0145) n = 25,181	81.9 (0.0142) n = 27,317	81.9 (0.0124) n = 34,676
2002	81.9 (0.0118) n = 30,013	81.9 (0.0119) n = 29,313	82.0 (0.0114) n = 32,511	81.8 (0.0105) n = 35,759
2003	81.7 (0.0117) n = 27,686	81.6 (0.0110) n = 30,400	81.6 (0.0099) n = 35,741	81.6 (0.0098) n = 35,635
2004	81.8 (0.0117) n = 35,768	81.9 (0.0116) n = 39,819	81.6 (0.0107) n = 40,102	82.0 (0.0112) n = 42,189
2005	82.1 (0.013) n = 32,599	81.9 (0.012) n = 35,827	81.9 (0.011) n = 42,303	82.6 (0.012) n = 42,453

Standard errors in parentheses.

Distribution of Gas Furnace Sales by Efficiency Category

Figure 5-5 illustrates the distribution of gas furnaces sold by AFUE category. As shown, most units sold throughout the past three years had AFUE ratings between 78 and 80. As expected, the percent of high efficiency (above 90 AFUE) units sold has increased slightly over time. The exception to this is the decrease in furnaces with an AFUE above 90 seen in 2002 from the 2001 level. Sales of furnaces above 90 AFUE increased to 11.4% in 2005, matching the previous high reached in 2001.

Figure 5-5: Gas Furnaces, Percent of Sales by AFUE Level



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Summary

This report described the data development and results of the 2005 HVAC component of California's ongoing RMST project. The results presented herein do not reveal significant deviations in the expected trends of HVAC equipment efficiencies. The average SEER of CACs increased steadily from 1999 through 2002, decreased slightly in 2003, then increased again in 2004 and 2005. The average cooling efficiency rating for air-source heat pumps decreased slightly in 2005, due to the loss of a vendor who sold predominantly high efficiency heat pumps. The average AFUE of central gas furnaces has remained relatively steady since 1999, vacillating between 81.0 and 82.6 throughout the study period.

In addition to tracking the average equipment efficiency ratings, this study estimates the share of ENERGY STAR qualified units sold. While such estimates are valuable, the results with respect to central air conditioners illustrate how changes in the ENERGY STAR qualifying criteria impact the trend. In particular, the share of ENERGY STAR qualified CACs dropped from 32.9% in the last quarter of 2002 to 5.1% in early 2003. This statistic could be misleading without prior knowledge regarding changes to the ENERGY STAR specification. Examining both the average efficiency and the share of ENERGY STAR qualified units *together* is far more meaningful. The ENERGY STAR market share of CACs and furnaces increased in 2005 compared to the average 2004 shares. The decrease in average heat pump efficiency and ENERGY STAR share in 2005 are at least partly attributable to the loss of a distributor to the panel that sold a relatively high percentage of ENERGY STAR heat pumps.