SBW Consulting, Inc.
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FINAL REPORT

DEVELOPING ENERGY EFFICIENCY RATING MATRIX FOR MEASURES SUBJECT TO CALIFORNIA AND FEDERAL MINIMUM APPLIANCE EFFICIENCY STANDARDS

Submitted to

BASE EFFICIENCY STUDIES SUBCOMMITTEE
CALIFORNIA DSM MEASUREMENT ADVISORY COMMITTEE

Submitted by

SBW CONSULTING, INC.
2820 Northup Way, Suite 230
Bellevue, WA 98004

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1.0 Introduction

The purpose of this study is to develop a matrix of efficiency ratings for appliances which are subject to federal or California efficiency standards, or which will be subject to such standards in 1994. This matrix will be used by CADMAC utilities in the evaluation of appliance energy efficiency programs. For those participants and nonparticipants who installed the appliance or equipment regardless of its efficiency level, the effects of state and federal standards on pre-installation usage, base usage and load impact estimates must be accounted for.

To quantify the savings associated with installation of new energy efficient appliances, a reliable database of baseline appliance efficiencies is needed. While appliance efficiency standards indicate the minimum allowable efficiencies for many appliances, not all energy using equipment is subject to standards, and furthermore the average efficiency of equipment sold in a particular year will always be somewhat higher than that required by the standards. This is due to the fact that equipment that exceeds the standards is sold, whereas equipment that does not meet the standard is not.

This study has delineated the appliances subject to federal and California standards, their rating parameters, their rating values, and to the extent possible the average stock efficiencies from 1977 to the present. Legislative initiatives by the U.S. Congress that may become law have also been reviewed to anticipate future standard setting events.

1.1 Study Objectives

There are three potential applications of the matrices developed by this study. One application is in the calculation of energy use for appliances which conform to the current and 1994 standards. Efficiency ratings from this study could be used to determine the maximum net impact of appliance efficiency programs. The minimum standard would be used to estimate the maximum energy use for a participant's replacement appliance. This could be compared to the energy use of the appliance purchased through the efficiency program. For this application only the current and 1994 standards are relevant.

Another potential application is in the estimation of energy use for currently installed appliances (old appliances). The ratings could be used to develop UEC data for end-use forecasting and to establish the baseline energy use for participants in efficiency programs. These data would be used to calculate the gross program savings by comparing the energy use of current appliances to the energy use of appliances purchased through the program. For this application all vintages of appliances are relevant. However, due to the variation of efficiency across makes and models of appliances, this application could be better served by a database of penetration rates and efficiency ratings for specific makes and models in present use.

The third application is in the estimation of energy use for appliances which exceed the current and 1994 standards and are included in efficiency programs. This is very similar to the second application. These data would support the other half of the equation which estimates gross program savings, i.e., the portion which estimates the energy use of appliances purchased by the program. As for the second application, the variation in efficiency across make and model argues against organizing the matrices by vintage. Instead, this application requires a database of counts and ratings which are specific to appliance make and model.

1.2 Organization of the Report

The report is organized into seven sections and two appendices. Following this introduction, Section 2 describes the history of appliance standards promulgated by the State of California and the U.S. Department of Energy. This section also describes possible future standards. Section 3 introduces the various energy efficiency ratings used to quantify appliance efficiency levels and recommends parameters to be used for particular measures. Section 4 summarizes the information assembled to date on actual appliance efficiency levels and discusses some of the problems and possible solutions to routinely obtaining these data. Section 5 describes the energy efficiency matrices developed for this project, and Section 6 provides recommendations for further research to improve and supplement these matrices. Section 7 is a bibliography of documents used in the preparation of this document.

Two appendices summarize the findings of this study. Appendix A is a listing of the appliance standard setting events affecting California. Appendix B is a matrix listing the various energy efficiency measures offered by the largest investor owned utilities in California.

2.0 Appliance Standards

Appliance efficiency standards were first promulgated by the State of California in 1974. Soon thereafter the U.S. Congress directed the Federal Energy Administration (now known as the U.S. Department of Energy (U.S. DOE)) to develop voluntary appliance standards. In 1978, the U.S. DOE was directed to develop mandatory minimum standards for thirteen common appliances. It was not until 1987, however, that these standards were finally promulgated.

Table 2.1 provides a summary of the effective years of standards legislated for particular appliances in California. This table includes both the California and U.S. DOE standard setting events. The number of individual appliances or setting events for each appliance type is also indicated. The table reflects that one effect of the controversy surrounding appliance efficiency standards was marked reduction of activity from 1980 to 1990. Appendix A provides the detailed listing of over 350 standard setting events uncovered by this study. This appendix indicates the appliance name, the appliance type, the effective date (month and year) of the standard, the rating parameter used, and the rating value.

Section 2.1 describes the history of appliance standards promulgated by the State of California, and Section 2.2 describes the federal government's appliance standards activities. Section 2.3 discusses current plans for future appliance standards. Section 3 will discuss the rating parameters to aid in the interpretation of this Appendix A.

2.1 Standards Promulgated by the State of California

Energy efficiency standards for appliances were set in motion on May 21, 1974 when Governor Reagan signed AB 1575, known as the Warren Alquist State Energy Resources Conservation and Development Act. One of the required actions was to prescribe standards for minimum levels of operating efficiency for all appliances that the California Energy Commission determines use a significant amount of energy on a state-wide basis. The levels of the standards are to be based on "feasible and attainable efficiencies or feasible improved efficiencies" and must be set at levels that do not result in "any added total costs to the consumer over the designed life of the appliance concerned." The statute provides that one year after a standard is adopted no new appliance may be sold unless the manufacturer certifies that the appliance complies with the standard. These standards covered refrigerators, refrigerator-freezers, freezers, room air conditioners, central air conditioners, gas furnaces, water heaters, and plumbing fittings.

Two additional legislative provisions modified the Warren-Alquist Act's provisions for appliance efficiency standards. The first one, which went into effect in 1975, required that no new residential-type gas appliance (except water heaters) with a pilot light can be sold 24 months after the Commission certifies an intermittent ignition device (IID) as an alternate means to a pilot light on the appliance. The other change modified the timing of standard implementation. This change allows one year after the effective date (or two years after adoption) for wholesalers and retailers to clear their inventories of noncomplying models manufactured before the effective date. Other actions have reset the minimum standards and added fluorescent lamp ballasts and large air conditioners to the list of covered appliances. When the U.S. Department of Energy promulgated appliance standards for consumer products

Table 2.1: California Appliance Standards

Appliance	Number of Items	Effective Years																	
		77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94
Boilers	28											x				x	x		
Central Air Conditioners	87	x		x					x				x			x	x		
Central Furnaces	35		x					x							x	x	x	x	
Central Heat Pumps	2		x	x															
Clothes Dryers	6			x															x
Clothes Washers	4												x						x
Dishwashers	3												x						x
Electric Heaters	4				x			x											
Electric Water Heaters	7		x												x	x			
Freezers	14			x								x			x		x	x	
Gas Pool Heaters	2			x											x				
Gas Space Heaters	46		x			x						x			x				
Gas Water Heaters	29		x	x		x									x	x	x	x	
Household Cooking	2		x												x				
Lamp Ballasts	9							x							x				
Lavatory Faucets	2		x														x		
Oil Water Heaters	7														x	x		x	
Refrigerator-Freezers	34	x		x								x			x		x	x	
Refrigerators	6	x		x								x			x		x	x	
Room Air Conditioners	26	x		x											x	x	x		
Showerheads	2		x														x		
Sink Faucets	2		x														x		
Tub Spout Diverters	2																x		

(as discussed in Section 2.2), the CEC promulgated identical regulations for non-consumer products to ensure complete coverage in the State of California.

2.2 Standards Promulgated by the U.S. Government

In 1975 the U.S. Congress passed the Energy Policy and Conservation Act (EPCA), requiring the Federal Energy Administration (now subsumed by the U.S. DOE), to develop voluntary appliance efficiency targets. These targets were to represent reductions in energy use of new appliances of at least 20% by 1980 compared to their known 1972 levels. In 1978 the Department of Energy was directed to develop mandatory appliance efficiency standards for 13 categories of new products under the National Energy Conservation Policy Act (NECPA). These categories are: 1) refrigerators and refrigerator-freezers, 2) freezers, 3) dishwashers, 4) clothes dryers, 5) water heaters, 6) room air conditioners, 7) home heating equipment (not including furnaces), 8) television sets, 9) kitchen ranges and ovens, 10) clothes washers, 11) humidifiers and dehumidifiers, 12) central air conditioners, 13) furnaces, and 14) any other type of consumer product defined by the Administrator. On January 2, 1979, DOE published a notice of proposed rulemaking for nine priority products for which final regulations would be promulgated by January 2, 1982.

DOE proposed regulations for eight of the thirteen covered products in June 1980. The following January, DOE notified Congress that the new appliance standards were essentially complete. Later that month, however, the newly arrived Reagan administration requested that Congress repeal the DOE appliance standards program on the grounds that it represented inappropriate regulatory policy. The next month, after Congress had not acted on the proposal, DOE announced that a new review of the economic analysis underlying the standards was necessary before the Department could promulgate them. In October, a citizen suit (NRDC vs. Edwards) was brought against DOE to compel promulgation of the standards. The suit was settled in 1982, after DOE published a notice of proposed rulemaking for eight of the nine priority covered products; the notice proposed that "no standards" standards be adopted. A second citizen suit (NRDC vs. Herrington) in late 1983 challenged the "no standards" standards as contrary to law. Agreeing with the petitioners, the U.S. Court of Appeals voided the DOE rules in July 1985 as arbitrary and capricious interpretations of the EPCA as amended and directed DOE to initiate new rulemaking.

As mentioned above, California and a few other states had established their own appliance efficiency standards during the 1970 and 1980's. This emerging mix of State standards motivated the appliance manufacturing industry to seek uniform national standards. As a result, legislation was introduced in August of 1986 in both Houses of Congress, and enacted into law on October 15, as H.R. 5465, to propose actual minimum standards by statute for the EPCA covered products. This bill was pocket vetoed by President Reagan on November 1, 1986, arguing that appliance efficiency standards were not consonant with the administration's policy of minimal Federal involvement in the marketplace. The next year, however, Congress passed an essentially identical bill (S.83 or the National Appliance Energy Conservation Act) on March 3, and the President signed it on March 17, 1987, fully nine years after the originally intended start.

Amendments to NAECA, passed in 1988 (Public Law 100-357), added fluorescent lamp ballasts and pool heaters to the list of EPCA covered products and established minimum efficiency levels for them. DOE has upgraded many of these standards, as required by law, to reflect cost-effective energy efficiency levels. An unusual provision of the appliance standards is that they supersede any State standards, even if the state standards are more strenuous. There is a provision by which States can petition the DOE to grant exemptions for emergency circumstances, but to date none such exemptions have been granted.

2.3 Planned Future Standards

U.S. DOE is required to review (and update where necessary) all of these standards within three to ten years depending upon the appliance. New or amended standards are required to achieve the maximum improvement in energy efficiency that is both technologically feasible and economically justified. In no case may DOE revisions to NAECA standards allow a decrease in the efficiency (or increase in the energy use) of covered products. Table 2.2 indicates the scheduled dates for appliance standard updates by the U.S. DOE.

Table 2.2: Scheduled Dates for Appliance Standard Updates by U.S. DOE Product Type

PRODUCT	DATE
Refrigerator	1998
Refrigerator/Freezers	1998
Freezers	1998
Clothes Dryers	1998
Clothes Washers	1998
Dishwashers	1998
Central Air Conditioners	1999
Heat Pumps	1999
Room Air Conditioners	2000
Ranges and Ovens	2000
Furnaces	2002
Water Heaters	2005
Pool Heaters	2005
Central Air Conditioners	2006
Heat Pumps	2006
Furnaces	2012

DOE has yet to promulgate standards for television sets and humidifiers and dehumidifiers as called for in Public Law 100-357. The Code of Federal Regulations revision of January 1, 1993 includes testing procedures for television receivers, but does not set minimum efficiency levels. The American Council for and Energy Efficient Economy (ACEEE) has recently helped draft legislation in consultation with manufacturers for several products that are not presently included in the federal statutes. These products and effective dates if approved by Congress are listed in Table 2.3.

Table 2.3: Summary of New Standards by Product Type

PRODUCT	EFFECTIVE DATE
Four foot fluorescent lamps	1996
Eight foot fluorescent lamps	1994
General service incandescent lamps	2001
Incandescent reflector lamps	1996
High intensity discharge lamps	1999
Motors 1-200 horsepower	1998
Motors less than one horsepower	2002
Showerheads	1993
Packaged air cooled A/C and heat pumps	1994
Packaged water cooled A/C and heat pumps	1994
Packaged terminal A/C and heat pumps	1994
Water heaters	1994
Distribution transformers	not specified

The effective dates above assumed a bill would be signed into law in the fall of 1992. Since this did not happen for these items, the actual effective dates are yet to be determined.

Complying lamps will have average lumen per watt values that are 2-20% higher than the standard lamps eliminated when the standards take effect. Under the proposed legislation, DOE must review and revise the lighting standards if warranted five and ten years after passage. The legislation also requires DOE to consider standards on high intensity discharge lamps within three years of enactment. This rulemaking could prohibit further production of mercury vapor lamps.

The efficiency of motors that will be required when the standards take effect are typically 2-10% greater than ordinary motors, depending on size. Manufacturers will have five to seven years to test and certify complying items. For motors that must be certified by Underwriters Laboratory (UL), or that are used in UL certified equipment, an additional two years is allowed.

Showerheads standards are already in effect in California, however DOE may at some time supersede these with national standards for showerheads and faucets. The proposed legislation contains flow rate standards for showerheads, kitchen faucets, and bathroom faucets of 2.5 gallons per minute at a water pressure of 80 psi. If DOE concludes that more stringent standards are technically feasible and economically justified, it can waive preemption of state standards but not issue stronger federal standards without action by the American Society of Mechanical Engineers.

Existing appliance standards cover heating and cooling equipment used in housing and small commercial buildings. For example, existing standards apply only to heat-pump and air conditioners smaller that 135,000 Btuh (11.25 ton). The proposed legislation extends standards to certain types of larger air conditioning systems, heat pumps, boilers, and water heaters. The initial minimum efficiency requirements are derived from ASHRAE Standard 90.1, the most recent model conservation standard issued by the American Society of Heating, Refrigerating, and Air Conditioning Engineers. For packaged air conditioners and heat pumps of 12-20 tons cooling capacity, the effective date is 1995. For packaged cooling equipment only the full load values are to be included in national legislation in the interest of keeping the standards simple. The HVAC standards can be updated after ASHRAE revises its model standards.

The proposed legislation requires DOE to consider issuing minimum efficiency standards on utility distribution transformers. Distribution transformers consume approximately 2% of electricity generated in the U.S., and high efficiency transformers can reduce these losses by 65-80%. The legislation requires DOE to issue transformer efficiency standards if feasible within three years from the date of enactment.

3.0 Energy Efficiency Rating Parameters

A necessary prerequisite to promulgation of an appliance efficiency standard is the development of testing procedures and rating parameters used to determine compliance. Over the course of the past two decades some of the testing procedures and rating parameters have changed. This is particularly true with respect to heating, ventilating, and air conditioning equipment. The various rating parameters are defined in Section 3.1. Section 3.2 proposes various appliance categories and recommended rating parameters.

3.1 Rating Parameter Definitions

Listed below are definitions for relevant appliance rating parameters. Many of these definitions are based upon specified test procedures that are described in the Code of Federal Regulations. For the sake of brevity, these testing procedures are not described below.

Annual fuel utilization efficiency (AFUE): the percentage of heat from the combustion of fuel that is transferred to the space being heated under specified testing conditions.

Ballast efficacy factor (BEF): ratio of relative light output divided by the power input of a fluorescent lamp ballast, as measured under test conditions specified in ANSI Standard C82.2-1984.

Coefficient of performance (COP) – cooling: ratio of the rate of heat removal to the rate of energy input in consistent units for a complete system or factory assembled equipment, as tested under a nationally recognized standard or designated operating conditions.

Coefficient of performance (COP) -- heating: ratio of heat delivered to the rate of energy input, in consistent units, for a complete heat pump system under designated operating conditions without supplemental heat elements.

Combustion efficiency: percentage of heat from the combustion of fuel transferred to the load at specified steady state conditions.

Energy consumption: the rate of energy use at steady state conditions.

Energy efficiency ratio (EER): ratio of the cooling capacity of an air conditioner in British thermal units per hour to the total electrical input in watts under specified test conditions.

Energy factor for clothes dryers (EF): the pounds of water removed from laundry per kilowatt-hour consumed.

Energy factor for clothes washer (EF): the cubic footage of laundry washed per kilowatt-hour consumed per washer cycle.

Energy factor for dishwashers (EF): the number of dishwasher cycles completed per kilowatt-hour consumed.

Energy factor for refrigerators (EF): the number of adjusted cubic feet refrigerated under standard testing procedures per kilowatt-hour consumed per day.

Energy factor for water heaters (EF): the average ratio of the heat content of heated water to the energy consumed after a set of six test cycles.

Flow rate of a tub spout diverter: the leakage through the diverter directly into the bathtub when the device is in the diverting position.

Heating seasonal performance factor (HSPF): total heating output of a central air-conditioning heat pump in British thermal units during its normal usage period for heating divided by the total electrical energy input in watt-hours during the same period as determined using specified test procedures.

Integrated part-load value (IPLV): a single number figure of merit based on part-load EER or COP expressing part-load efficiency for air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the equipment. This is similar in concept to SEER wherein the performance parameter is based upon a range of operating conditions rather than a single full load value.

Intermittent ignition device (IID): an automatic ignition system for combustion heaters obviating the need for a constant burning pilot light.

Maximum flow rate: the greatest permissible volume of water released per unit of time by a showerhead or faucet.

Seasonal efficiency (SE): the percentage of heat from the combustion of gas fuel and associated electrical equipment that is transferred to the space being heated during a year under specified conditions.

Seasonal energy efficiency ratio (SEER): total cooling output of a central air conditioner in British thermal units during its normal usage period for cooling divided by the total electrical energy input in watt-hours during the same period as determined using specified test procedures to represent overall seasonal performance.

Thermal efficiency: the percentage of heat from the combustion of fuel that is transferred to a space being heated under steady state conditions.

Standby energy consumption: the energy consumed by a device when it is not being used.

Standby loss of a storage-type water heater: when expressed as a percentage means the ratio of heat loss per hour to the heat content of the stored water above room temperature; when expressed in watts per square foot means the heat loss per hour, per square foot of tank surface area.

3.2 Recommended Rating Parameters

Table 3.1 provides a listing of generic product classes and associated rating parameters recommended as a result of this study. In general the rating parameters recommended are those specified by the current standards. This is the case because equipment manufacturers must conduct tests to establish these parameters for all equipment they distribute that falls under the purview of the California or Federal appliance standards.

In some cases parameters may be converted with simple multipliers, such as changing from coefficient of performance to energy efficiency ratio. In other cases it would be necessary to subject equipment to different testing protocols to convert, such as from energy efficiency ratios to seasonal energy efficiency ratios. In this particular case, EER's were in common use prior to 1980, and then SEER's became the more accepted rating parameter for air conditioners and heat pumps. While the standards specified EER levels until 1990, the only shipment weighted efficiency data available is expressed in SEER's after 1980.

Table 3.1: Appliance Categories and Suggested Rating Parameters

ITEM CODE		Product Class	Rating Parameter
1	A	Boilers less than 300,000 BTUH	AFUE
1	B	Boilers 300,000 BTUH and larger	Thermal efficiency
2	A	Central AC - air source heat pumps	SEER and HSPF
2	B	Central AC - water source heat pumps	EER
2	C	Central AC - single package systems	SEER and HSPF
2	D	Central AC - split systems	SEER and HSPF
2	E	Central AC - unitary evaporatively cooled	EER
2	F	Central AC - unitary water cooled	EER
3	A	Central Furnaces less than 225,000 BTUH	AFUE
3	B	Central Furnaces 225,000 BTUH or larger	Thermal efficiency
3	C	Central Furnaces - duct type	Thermal efficiency
3	D	Central Furnaces - unit heaters	Thermal efficiency
4	A	Clothes Dryers - compact	Energy Factor (lbs/kWh)
4	B	Clothes Dryers - standard	Energy Factor (lbs/kWh)
5	A	Clothes Washers less than 1.6 cuft	Energy Factor (cuft/kWh/cycle)
5	B	Clothes Washers 1.6 cuft and larger	Energy Factor (cuft/kWh/cycle)
6	A	Dishwashers - compact	Energy Factor (cycles/kWh)
6	B	Dishwashers - standard	Energy Factor (cycles/kWh)
7	A	Electric Heaters - non central	Thermal efficiency
8	A	Electric Water Heaters - storage type	Energy Factor (dimensionless)
8	B	Electric Water Heaters - instantaneous	Energy Factor (dimensionless)
9	A	Freezers - chest	Energy Factor (cuft/kwh/cycle)
9	B	Freezers - upright auto defrost	Energy Factor (cuft/kwh/cycle)
9	C	Freezers - upright manual defrost	Energy Factor (cuft/kwh/cycle)
10	A	Gas Space Heaters - floor type	Seasonal efficiency
10	B	Gas Space Heaters - wall fan type	Seasonal efficiency
10	C	Gas Space Heaters - wall gravity type	Seasonal efficiency
11	A	Gas Water Heaters less than 155,000 BTUH	Thermal efficiency
11	B	Gas Water Heaters 155,000 BTUH or larger	Thermal efficiency
11	C	Gas Water Heaters - instantaneous	Energy Factor (dimensionless)
12	A	Household Cooking	IID Presence
13	A	Lamp Ballasts	Ballast efficacy factor
14	A	Oil Water Heaters less than 155,000 BTUH	Thermal efficiency
14	B	Oil Water Heaters 155,000 BTUH or larger	Thermal efficiency
14	C	Oil Water Heaters - instantaneous	Energy Factor (dimensionless)
15	A	Refrigerator-Freezers - manual defrost	Energy Factor (cuft/kwh/cycle)
15	B	Refrigerator-Freezers - top freezer	Energy Factor (cuft/kwh/cycle)
15	C	Refrigerator-Freezers - bottom freezer	Energy Factor (cuft/kwh/cycle)
15	D	Refrigerator-Freezers - side freezer	Energy Factor (cuft/kwh/cycle)
15	E	Refrigerator-Freezers - top freezer w/ door ice service	Energy Factor (cuft/kwh/cycle)
15	F	Refrigerator-Freezers - side freezer w/ door ice service	Energy Factor (cuft/kwh/cycle)
16	A	Refrigerators - manual defrost	Energy Factor (cuft/kwh/cycle)
16	B	Refrigerators - auto defrost	Energy Factor (cuft/kwh/cycle)
17	A	Room Air Conditioners - heat pumps	EER
17	B	Room Air Conditioners - non heat pumps	EER
17	C	Room Air Conditioners - w/ reverse cycle	EER
17	D	Room Air Conditioners - w/o reverse cycle	EER
17	E	Room Air Conditioners - w/ louvers	EER
17	F	Room Air Conditioners - w/o louvers	EER
18	A	Showerheads	Maximum flow rate
19	A	Sink Faucets	Maximum flow rate
20	A	Tub Spout Diverters	Maximum flow rate

4.0 Actual Appliance Efficiency Levels

It is difficult to obtain accurate information for shipments to California from the national trade associations owing to confidentiality and technical concerns. Trade associations will not release data that would allow a reader to determine competitive market shares, and in most cases have no information regarding interstate trans-shipments. Consequently, the values provided are national average shipments for the most part. The California Energy Commission has done some work to compare average California appliance efficiencies with national statistics, and when available we have used California specific information. The California only values are indicated with shading in the efficiency tables below.

4.1 Shipment Weighted Appliance Efficiency Data

Table 4.1 indicates the shipment weighted efficiency data obtained to date for 17 product categories.

4.2 Estimated Appliance Efficiency Data

Using the data from Table 4.1 we have extrapolated and interpolated values using a least-squares linear regression to fill empty cells where there was a sufficient number of entries. These data are shown in Table 4.2. Phase 3 of this research will determine the best methods to fill remaining data gaps.

4.3 Appliance Efficiency Data Sources

We have endeavored to obtain estimates of shipment weighted average efficiency levels for the most common appliances. These data are derived from secondary sources, where significant efforts were expended to either purchase information from trade associations, survey equipment manufacturers, survey equipment distributors, and/or survey equipment purchasers.

The sources of nation-wide data are indicated in Table 4.3. The California only data were extracted from a California Energy Commission staff report entitled "California Market Trends for More Efficient Appliances: An Analysis of California and National Shipment Data in the Early 1980's". This report was also used to supplement some of the nation-wide data as well. Full bibliographic citations for these reports are provided in Section 7.

Table 4.1 Shipment Weighted Appliance Efficiency Data
Last Updated September 23, 1993

Appliance	Paramete	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Unitary Air Conditioners	EER	7.03	7.13	7.34	7.47	7.55												
Unitary Heat Pumps	EER	6.87	6.89	7.24	7.34	7.51												
Split Systems	EER	7.16	7.18	7.42	7.45	7.51												
Unitary Air Conditioners	SEER						7.78	8.31	8.43	8.66	8.82	8.87	8.97	9.11	9.25	9.31		
Unitary Heat Pumps	SEER						7.97	7.79	8.23	8.31	8.56	8.70	8.93	9.13	9.26	9.46		
Split Systems	SEER						7.73	8.30	8.44	8.70	8.84	8.87	8.95	9.11	9.23	9.29		
Top-Mount Refrigerators	EF			4.96		5.59	6.21	6.12	6.39	6.60				7.83	8.06	8.51	8.90	
Side-by-Side Refrigerators	EF						5.91			6.18				7.44	7.67	7.76	8.27	
Manual Defrost Refrigerators	EF													5.09	4.55	4.84	4.32	
Chest Freezers	EF					12.44	12.44	12.93	13.03	13.31				14.46	15.48	15.67		
Upright Manual Defrost Freezers	EF					10.85	10.89	11.28	11.36	11.91				12.61	13.86	14.15		
Upright Automatic Defrost Freezers	EF													9.31	9.47	10.41		
Electric Water Heaters	TE			80.70		78.30			83.00		83.60							
Gas Water Heaters	TE			48.20		47.90				49.40								
Central Gas Furnaces	SE			63.60		63.30	61.30		69.60	75.10				75.00			79.64	82.14
Room Air Conditioners	EER			6.75		7.02	6.91	7.14	7.29	8.61	7.70			8.23	8.48	8.73		
Central Air Conditioners	SEER						8.46			8.79								
Dishwashers	EF													0.37	0.37	0.37		
Clothes Washers	EF													0.95	0.98	0.99		
Elec Dryers with Automatic Control	Percent													74.20	73.80	73.30		
Gas Dryers with Automatic Control	Percent													81.40	82.20	84.40		

* Shaded boxes are California shipment based, others are nation-wide

Table 4.2: Extrapolated Appliance Efficiency Data
Last Updated September 23, 1993
Linear Regression Filled

Appliance	Parameter	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Unitary Air Conditioners	SEER	7.33	7.48	7.63	7.78	7.93	7.78	8.31	8.43	8.66	8.82	8.87	8.97	9.11	9.25	9.31	9.58	9.73	9.88
Unitary Heat Pumps	SEER	6.77	6.96	7.16	7.35	7.55	7.7	7.79	8.23	8.45	8.56	8.7	8.93	9.13	9.26	9.46	9.69	9.89	10.1
Split Systems	SEER	7.33	7.47	7.62	7.77	7.92	7.73	8.3	8.44	8.7	8.84	8.87	8.95	9.11	9.23	9.29	9.57	9.72	9.87
Top-Mount Refrigerators	EF	4.38	4.68	4.96	5.26	5.59	6.02	6.12	6.39	6.5	7	7.3	7.59	7.83	8.06	8.51	8.9	9.04	9.33
Side-by-Side Refrigerators	EF	4.32	4.58	4.83	5.09	5.34	5.72	5.85	6.11	6.18	6.62	6.87	7.13	7.44	7.67	7.76	8.27	8.41	8.66
Manual Defrost Refrigerators	EF													5.09	4.55	4.84	4.32		
Chest Freezers	EF	11	11.3	11.6	12	12.4	12.9	12.9	13	13	13.9	14.2	14.5	14.5	15.5	15.7	15.8	16.1	16.4
Upright Manual Defrost Freezers	EF	9.35	9.67	9.98	10.3	10.9	11.3	11.3	11.4	11.4	12.2	12.5	12.8	12.6	13.9	14.2	14.1	14.4	14.8
Upright Automatic Defrost Freezers	EF													9.31	9.47	10.4			
Electric Water Heaters	TE			80.7		78.3			83		83.6								
Gas Water Heaters	TE			48.2		47.9				49.4									
Central Gas Furnaces	SE			63.6		63.3	61.3	69.6	69.6	74	73.1	74.2	75.4	75	77.7	78.9	79.6	82.1	82.3
Room Air Conditioners	EER	6.26	6.43	6.75	6.76	7.02	7.06	7.14	7.29	7.6	7.7	7.93	8.1	8.23	8.48	8.73	8.77	8.94	9.1
Dishwashers	EF													0.37	0.37	0.37			
Clothes Washers	EF													0.95	0.98	0.99			
Elec Dryers with Automatic Control	Percent													74.2	73.8	73.3			
Gas Dryers with Automatic Control	Percent													81.4	82.2	84.4			

Table 4.3 Appliance Efficiency Data Sources Last Updated September 23, 1993

Appliance	Data Sources
Unitary Air Conditioners	ARI Statistical Profile, June 1991
Unitary Heat Pumps	ARI Statistical Profile, June 1991
Split Systems	ARI Statistical Profile, June 1991
Unitary Air Conditioners	ARI Statistical Profile, June 1991
Unitary Heat Pumps	ARI Statistical Profile, June 1991
Split Systems	ARI Statistical Profile, June 1991
Top-Mount Refrigerators	AHAM Shipment Data, 1992
Side-by-Side Refrigerators	AHAM Shipment Data, 1992
Manual Defrost Refrigerators	AHAM Shipment Data, 1992
Chest Freezers	AHAM Shipment Data, 1992
Upright Manual Defrost Freezers	AHAM Shipment Data, 1992
Upright Automatic Defrost Freezers	AHAM Shipment Data, 1992
Electric Water Heaters	ACEEE, 1985
Gas Water Heaters	GAMA Sales Data, 1992
Central Gas Furnaces	GAMA Sales Data, 1992
Room Air Conditioners	AHAM Shipment Data, 1992
Central Air Conditioners	AHAM Shipment Data, 1992
Dishwashers	AHAM Shipment Data, 1992
Clothes Washers	AHAM Shipment Data, 1992
Elec Dryers with Automatic Control	AHAM Shipment Data, 1992
Gas Dryers with Automatic Control	AHAM Shipment Data, 1992

5.0 Energy Efficiency Matrices

Appendix A is a print-out of the current appliance efficiency matrix. This print-out is produced from a Quattro Pro (TM) spreadsheet that is available from the report author to facilitate easy updating and application. The text below describes the contents of the matrix.

5.1 Appliance

The first column of Appendix A indicates thirty-six distinct appliance categories for which a Federal and/or California standard is in effect. The abbreviation "NC" stands for non-consumer products as defined by the Federal standards. Although the federal government does not regulate these items, the state of California does. These categories are generally consistent with the California Conservation Inventory Group (CCIG) classifications. They are listed alphabetically.

5.2 Appliance Type

The second column of Appendix A indicates the specific types of appliances called out in the efficiency standards. These subcategories have particular features that lead to unique rating parameters or rating parameter values. The identical type is listed as often as new standards for it have been promulgated.

5.3 Effective Date

The month and year that a standard, or revision to the standard, was promulgated is indicated in the third and fourth columns of Appendix A. The effective dates of the standard extend from the date listed until the next update (if any).

5.4 Rating Parameter

The rating parameter(s) specified by the efficiency standard is indicated in column 5 of Appendix A. If multiple parameters appear this means that more than one parameter applies to the appliance type.

5.5 Parameter Values

The last column of the matrix in Appendix A indicates the parameter values that apply to the appliance according to the most recent appliance standard update. These values are typically the minimum allowable efficiency levels. In some cases only the presence of a feature is mandated (eg. intermittent ignition devices), in others the value is dependent upon appliance size (eg. refrigerators). If more than one value is indicated, they correspond to the rating parameters respectively.

6.0 Recommendations for Further Research

This study has determined the relevant appliance standards and rating parameters that are needed to assess the minimum acceptable efficiency levels of appliances sold in California. It has also compiled the available data on average efficiencies of appliances distributed nationally, and in some cases appliances sold only in California. The validity of the average efficiency data is questionable, due in part to data limitations, confidentiality concerns, definition inconsistencies, and time lags associated with data development. These types of problems suggest that it is important for CADMAC to sponsor supplemental research to stipulate consistent rating parameters and acquire reliable estimates of average appliance efficiency levels. This present work has helped to define the issues and identify data gaps to focus this research.

The recommendations for further research focus upon two areas. The first area is to maintain current information on forthcoming appliance efficiency standards, and to ensure that the data collection on average stock data provides the information to assess relative efficiency levels. This entails a relatively straightforward tracking of federal and California legislation pertaining to appliances.

The second area is to refine and supplement the information available on average stock efficiency levels, both historically and into the future. This information is essential to accurately estimate the energy savings attributable to appliance rebate programs, so as to properly establish the baseline efficiency levels in the absence of the rebates. Appliance standards indicate only the minimum allowable efficiency levels, making savings claims using them for baseline efficiency levels artificially high. Accurate information regarding annual appliance purchases by efficiency level is essential to establish baseline equipment efficiencies for a fair comparison to the efficiencies of the rebated equipment. What is needed is a database containing historical appliance stock efficiencies and a procedure for regular updates.

Listed below are several options for obtaining the necessary average appliance efficiency data. Efforts are presently underway under Phase 3 of this research to examine these options more fully and make specific recommendations for the collection of appliance efficiency data. In addition, the Electric Power Research Institute is proposing a collaborative National Equipment Sales Project to assemble this type of data.

6.1 Trade Association Database Queries

Three national trade associations compile appliance shipment and efficiency data. These are the Association of Home Appliance Manufacturers (AHAM), the Air Conditioning and Refrigeration Institute (ARI), and the Gas Appliance Manufacturers Association (GAMA). Each of these organizations are provided with data from manufacturers pertaining to the number of units shipped according to specified product classes. These classes include various efficiency categories, and in some cases actual efficiency levels.

The California Energy Commission purchased national appliance sales data by efficiency category from AHAM for the years 1988-1990 for approximately $20,000 covering

refrigerators, room air conditioners, dishwashers, clothes washers, and dryers. The CEC is proposing for the CCIG to obtain the national level data from AHAM for calendar years 1991 and 1992 and to collect this data at the service territory level in calendar year 1993. The cost is estimated to be $75K.

They also have proposed to negotiate a separate contract with ARI to gather 1992 and 1993 sales data on central air conditioners and small commercial package units. This work was estimated to cost approximately $40K. This effort has been put on-hold pending the outcome of the third phase of this research. .

6.2 Manufacturer and Distributor Sales Surveys

HBRS Inc. has had some success obtaining refrigerator sales data from a sample of California appliance wholesalers and national equipment distributors. They have found that on-site surveys are the most effective, so that they can establish a rapport with the appropriate individuals. It is feasible to use a similar approach for other appliance types and to routinely pay for such sales summaries from a statistically valid number of distributors and manufacturers. This has the advantage of relatively quick response and complete knowledge regarding data sources, representativeness, and quality. It may be possible to obtain some amount of historical data while setting up a procedure for ongoing assembly of this information.

6.3 Point of Sales Tracking

With the advent of Uniform Product Codes (UPC) many retailers are maintaining computerized records of product sales and shipments. Others probably keep reasonably good records of sales by make and model number. Purchase of these data from a statistically representative group of appliance retailers appears to be a promising method to acquire accurate and timely sales data. Since most retailers predominantly serve particular utility service territories, it should be possible to assemble specific to the individual territories as well as sales of units qualifying for utility rebates. This approach to obtaining data also helps to foster good relationships with trade allies, and overcomes manufacturer and trade association concerns regarding the proprietary nature of the data.

6.4 Customer Surveys

It is possible to survey a large number of customers to obtain information regarding the purchase date, make, and model numbers, of appliances in the home. However, this will require calling a large number of customers and be subject to the vagaries of their recollection regarding purchase dates. Another problem is obtaining accurate model number information, however this might be overcome by maintaining computerized listings of model numbers and talking respondents through the process of finding the appropriate numbers. This has been found to be effective for refrigerators, but problematic for other appliances due to the difficulty of obtaining correct model number information. Follow-up site visits by trained surveyors may alleviate this problem however.

6.5 Nielson Group Style Tracking

It may be possible to select an appropriate sample of households that would report on a regular basis their purchases of new appliances, similar to the Nielson tracking for television viewership. This would require a very large sample size to ensure low variances in infrequently purchases appliances, but may be a viable follow-on to a customer survey effort. The costs could be quite low if the forms were easy to complete and sent in (and paid for) on an as occurs basis.

6.6 Consumer Reports Survey Information

Consumer Reports magazine obtains information from their readership on an annual basis regarding purchases of major appliances by model number. It may be possible to enter into an arrangement with them to share the costs and information assembled. Perhaps they would provide the data in return for the analysis results that would assist them prepare future articles.

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Appendix A

California Appliance Standards

This appendix contains a matrix that delineates appliance energy effiency standards in effect for the state of California. These include the standards promulgated by the U.S. Department of Energy and the California Energy Commission. The federal standards supercede state standards as they are applied to particular appliances unless a special petition is made and a waiver is granted. Federal standards are limited to "consumer products", defined as, "any article of a type which in operation consumes, or is designed to consume, energy; and which, to any significant extent, is distributed in commerce for personal use or consumption by individuals, without regard to whether such article or such type is in fact distributed in commerce for personal use or consumption by an individual. Products designed solely for use in recreational vehicles or other mobile equipment are not consumer products." The state of California has developed and maintained standards for many non-consumer products. These are noted in the tables by the initials "NC" following the appliance name.

The items are listed alphabetically by appliance, and appliance sub-type, and then by the effective date of the standard. Also indicated is the rating parameter(s) and rating value(s) stipulated by the standard. For the most part we have listed only the initial effective date for an appliance if subsequent standards did not revise the existing values.

Appliance Efficiency Matrix
Federal and California Efficiency Standards

Appliance	Type	Effective Date		Rating	Rating
		Month	Year	Parameter	Value
Boilers	<300,000 BTUH, non-steam boilers	1	1991	AFUE	>68%
Boilers	<300,000 BTUH, non-steam boilers	1	1992	AFUE	>80%
Boilers	<300,000 BTUH, nonweatherized, w/ continuous pilot	1	1987	AFUE and Standby Use	>63%,147W
Boilers	<300,000 BTUH, nonweatherized, w/ continuous pilot, LPG	1	1987	AFUE and Standby Use	>63%,293W
Boilers	<300,000 BTUH, nonweatherized, w/o continuous pilot	1	1987	AFUE and Standby Use	>65%,10W
Boilers	<300,000 BTUH, nonweatherized, w/o continuous pilot, LPG	1	1987	AFUE and Standby Use	>65%,293W
Boilers	<300,000 BTUH, steam boilers	1	1991	AFUE	>68%
Boilers	<300,000 BTUH, steam boilers	1	1992	AFUE	>75%
Boilers	<300,000 BTUH, weatherized, w/ continuous pilot	1	1987	AFUE and Standby Use	>61%,147W
Boilers	<300,000 BTUH, weatherized, w/ continuous pilot, LPG	1	1987	AFUE and Standby Use	>61%,293W
Boilers	<300,000 BTUH, weatherized, w/o continuous pilot	1	1987	AFUE and Standby Use	>63%,10W
Boilers	<300,000 BTUH, weatherized, w/o continuous pilot, LPG	1	1987	AFUE and Standby Use	>63%,293W
Boilers	>300,000 BTUH, max rated capacity	1	1987	Combustion Efficiency	>75%
Boilers	>300,000 BTUH, max rated capacity	1	1991	Combustion Efficiency	>75%
Boilers	>300,000 BTUH, max rated capacity	1	1992	Combustion Efficiency	>80%
Boilers	>300,000 BTUH, min rated capacity	1	1991	Combustion Efficiency	>72%
Boilers	>300,000 BTUH, min rated capacity	1	1992	Combustion Efficiency	>80%
Boilers	>300,000 BTUH, standby	1	1987	Energy Consumption	<147W
Boilers - NC	<300,000 BTUH, non-steam boilers	1	1991	AFUE	>68%
Boilers - NC	<300,000 BTUH, non-steam boilers	1	1992	AFUE	>80%
Boilers - NC	<300,000 BTUH, steam boilers	1	1991	AFUE	>68%
Boilers - NC	<300,000 BTUH, steam boilers	1	1992	AFUE	>75%
Boilers - NC	>300,000 BTUH, max rated capacity	1	1987	Combustion Efficiency	>75%
Boilers - NC	>300,000 BTUH, max rated capacity	1	1991	Combustion Efficiency	>75%
Boilers - NC	>300,000 BTUH, max rated capacity	1	1992	Combustion Efficiency	>80%
Boilers - NC	>300,000 BTUH, min rated capacity	1	1991	Combustion Efficiency	>72%
Boilers - NC	>300,000 BTUH, min rated capacity	1	1992	Combustion Efficiency	>80%
Boilers - NC	>300,000 BTUH, standby	1	1987	Energy Consumption	<147W
Central Air Conditioners	65,000 BTUH - 135,000 BTUH	1	1984	Energy Efficiency Ratio	8.2 for air, 9.2 for water
Central Air Conditioners	air source heat pump, <65,000 BTUH	1	1988	SEER and HSPF	>8.9,>6.6
Central Air Conditioners	air source, 65,000-135,000 BTUH	1	1984	Energy Efficiency Ratio	>8.2
Central Air Conditioners	air-cooled, non heat-pump, <65,000 BTUH	1	1988	Seasonal Energy Efficiency Ratio	>8.9
Central Air Conditioners	computer room, air cooled, 65,000-135,000 BTUH	1	1988	Energy Efficiency Ratio	>7.7
Central Air Conditioners	computer room, air cooled, <65,000 BTUH	1	1988	Energy Efficiency Ratio	>8.3
Central Air Conditioners	computer room, water cooled, 65,000-135,000 BTUH	1	1988	Energy Efficiency Ratio	>8.4
Central Air Conditioners	computer room, water cooled, <65,000 BTUH	1	1988	Energy Efficiency Ratio	>8.1
Central Air Conditioners	evaporative source, 65,000-135,000 BTUH	1	1984	Energy Efficiency Ratio	>9.2
Central Air Conditioners	heat-pumps	11	1977	Energy Efficiency Ratio	>6.7
Central Air Conditioners	heat-pumps	11	1979	Energy Efficiency Ratio	>7.5
Central Air Conditioners	non heat-pumps <65,000 BTUH	11	1977	Energy Efficiency Ratio	>7.0
Central Air Conditioners	non heat-pumps <65,000 BTUH	11	1979	Energy Efficiency Ratio	>8.0
Central Air Conditioners	water cooled, non heat-pump, <65,000 BTUH	1	1988	Energy Efficiency Ratio	>8.0
Central Air Conditioners	water source heat pumps, <65,000 BTUH	1	1988	EER and COP	>9.9,>3.2
Central Air Conditioners	water source, 65,000-135,000 BTUH	1	1984	Energy Efficiency Ratio	>9.2
Central Air Conditioners	single package system, air cooled, <65,000 BTUH	1	1993	SEER and HSPF	>9.7,>6.6
Central Air Conditioners	split system, air cooled, <65,000 BTUH	1	1992	SEER and HSPF	>10.0,>6.8
Central Air Conditioners - NC	air cooled, 65,000-135,000 BTUH, 80db	1	1991	Integrated Part Load Value	>7.3
Central Air Conditioners - NC	air cooled, 65,000-135,000 BTUH, 80db	1	1992	Integrated Part Load Value	>8.3
Central Air Conditioners - NC	air cooled, 65,000-135,000 BTUH, 80db	1	1993	Integrated Part Load Value	>8.3
Central Air Conditioners - NC	air cooled, 65,000-135,000 BTUH, 95db	1	1991	EER	>8.3
Central Air Conditioners - NC	air cooled, 65,000-135,000 BTUH, 95db	1	1992	EER	>8.9
Central Air Conditioners - NC	air cooled, 65,000-135,000 BTUH, 95db	1	1993	EER	>8.9
Central Air Conditioners - NC	air cooled, <65,000 BTUH, single package	1	1991	SEER	>8.9
Central Air Conditioners - NC	air cooled, <65,000 BTUH, single package	1	1992	SEER	>8.9

Appliance Efficiency Matrix
Federal and California Efficiency Standards

Appliance	Type	Effective Date		Rating	Rating
		Month	Year	Parameter	Value
Central Air Conditioners - NC	air cooled, <65,000 BTUH, single package	1	1993	SEER	>9.9
Central Air Conditioners - NC	air cooled, <65,000 BTUH, split system	1	1991	SEER	>8.9
Central Air Conditioners - NC	air cooled, <65,000 BTUH, split system	1	1992	SEER	>10.0
Central Air Conditioners - NC	air cooled, <65,000 BTUH, split system	1	1993	SEER	>10.0
Central Air Conditioners - NC	groundwater cooled heat pump, <135,000 BTUH, low-temp rating	1	1991	Energy Efficiency Ratio	>10.5
Central Air Conditioners - NC	groundwater cooled heat pump, <135,000 BTUH, low-temp rating	1	1992	Energy Efficiency Ratio	>11.5
Central Air Conditioners - NC	groundwater cooled heat pump, <135,000 BTUH, low-temp rating	1	1993	Energy Efficiency Ratio	>11.5
Central Air Conditioners - NC	groundwater cooled heat pump, <135,000 BTUH, standard rating	1	1991	Energy Efficiency Ratio	>10.0
Central Air Conditioners - NC	groundwater cooled heat pump, <135,000 BTUH, standard rating	1	1992	Energy Efficiency Ratio	>11.0
Central Air Conditioners - NC	groundwater cooled heat pump, <135,000 BTUH, standard rating	1	1993	Energy Efficiency Ratio	>11.0
Central Air Conditioners - NC	groundwater source heat pumps, high-temp rating	1	1991	Coefficient of Performance	>3.2
Central Air Conditioners - NC	groundwater source heat pumps, high-temp rating	1	1992	Coefficient of Performance	>3.4
Central Air Conditioners - NC	groundwater source heat pumps, high-temp rating	1	1993	Coefficient of Performance	>3.5
Central Air Conditioners - NC	groundwater source heat pumps, low-temp rating	1	1991	Coefficient of Performance	>2.8
Central Air Conditioners - NC	groundwater source heat pumps, low-temp rating	1	1992	Coefficient of Performance	>3.0
Central Air Conditioners - NC	groundwater source heat pumps, low-temp rating	1	1993	Coefficient of Performance	>3.0
Central Air Conditioners - NC	unitary evaporatively cooled, 65,000-135,000 BTUH, IPLV	1	1991	Integrated Part Load Value	>8.5
Central Air Conditioners - NC	unitary evaporatively cooled, 65,000-135,000 BTUH, IPLV	1	1992	Integrated Part Load Value	>9.7
Central Air Conditioners - NC	unitary evaporatively cooled, 65,000-135,000 BTUH, IPLV	1	1993	Integrated Part Load Value	>9.7
Central Air Conditioners - NC	unitary evaporatively cooled, 65,000-135,000 BTUH, standard rating	1	1991	Energy Efficiency Ratio	>10.5
Central Air Conditioners - NC	unitary evaporatively cooled, 65,000-135,000 BTUH, standard rating	1	1991	Energy Efficiency Ratio	>10.5
Central Air Conditioners - NC	unitary evaporatively cooled, 65,000-135,000 BTUH, standard rating	1	1991	Energy Efficiency Ratio	>9.5
Central Air Conditioners - NC	unitary evaporatively cooled, <65,000 BTUH, IPLV	1	1991	Integrated Part Load Value	>8.0
Central Air Conditioners - NC	unitary evaporatively cooled, <65,000 BTUH, IPLV	1	1992	Integrated Part Load Value	>8.5
Central Air Conditioners - NC	unitary evaporatively cooled, <65,000 BTUH, IPLV	1	1993	Integrated Part Load Value	>8.5
Central Air Conditioners - NC	unitary evaporatively cooled, <65,000 BTUH, standard rating	1	1991	Energy Efficiency Ratio	>9.0
Central Air Conditioners - NC	unitary evaporatively cooled, <65,000 BTUH, standard rating	1	1992	Energy Efficiency Ratio	>9.3
Central Air Conditioners - NC	unitary evaporatively cooled, <65,000 BTUH, standard rating	1	1993	Energy Efficiency Ratio	>9.3
Central Air Conditioners - NC	unitary water cooled air conditioners, 65,000-135,000 BTUH, standard rating	1	1991	Energy Efficiency Ratio	>9.5
Central Air Conditioners - NC	unitary water cooled air conditioners, 65,000-135,000 BTUH, standard rating	1	1992	Energy Efficiency Ratio	>10.5
Central Air Conditioners - NC	unitary water cooled air conditioners, 65,000-135,000 BTUH, standard rating	1	1993	Energy Efficiency Ratio	>10.5
Central Air Conditioners - NC	unitary water cooled air conditioners, <65,000 BTUH, IPLV	1	1991	Integrated Part Load Value	>8.0
Central Air Conditioners - NC	unitary water cooled air conditioners, <65,000 BTUH, IPLV	1	1992	Integrated Part Load Value	>8.3
Central Air Conditioners - NC	unitary water cooled air conditioners, <65,000 BTUH, IPLV	1	1993	Integrated Part Load Value	>8.3
Central Air Conditioners - NC	unitary water cooled air conditioners, <65,000 BTUH, standard rating	1	1991	Energy Efficiency Ratio	>9.0
Central Air Conditioners - NC	unitary water cooled air conditioners, <65,000 BTUH, standard rating	1	1992	Energy Efficiency Ratio	>9.3
Central Air Conditioners - NC	unitary water cooled air conditioners, <65,000 BTUH, standard rating	1	1993	Energy Efficiency Ratio	>9.3
Central Air Conditioners - NC	water source heat pump, 65,000-135,000 BTUH, standard rating	1	1991	Energy Efficiency Ratio	>9.5
Central Air Conditioners - NC	water source heat pump, 65,000-135,000 BTUH, standard rating	1	1992	Energy Efficiency Ratio	>10.5
Central Air Conditioners - NC	water source heat pump, 65,000-135,000 BTUH, standard rating	1	1993	Energy Efficiency Ratio	>10.5
Central Air Conditioners - NC	water source heat pump, <65,000 BTUH, low-temp rating	1	1991	Energy Efficiency Ratio	>9.7
Central Air Conditioners - NC	water source heat pump, <65,000 BTUH, low-temp rating	1	1992	Energy Efficiency Ratio	>10.2
Central Air Conditioners - NC	water source heat pump, <65,000 BTUH, low-temp rating	1	1993	Energy Efficiency Ratio	>10.2
Central Air Conditioners - NC	water source heat pump, <65,000 BTUH, standard rating	1	1991	Energy Efficiency Ratio	>9.0
Central Air Conditioners - NC	water source heat pump, <65,000 BTUH, standard rating	1	1992	Energy Efficiency Ratio	>9.3
Central Air Conditioners - NC	water source heat pump, <65,000 BTUH, standard rating	1	1993	Energy Efficiency Ratio	>10.0
Central Air Conditioners - NC	water source heat pumps, standard rating	1	1991	Coefficient of Performance	>3.3
Central Air Conditioners - NC	water source heat pumps, standard rating	1	1992	Coefficient of Performance	>3.8
Central Air Conditioners - NC	water source heat pumps, standard rating	1	1993	Coefficient of Performance	>3.8
Central Air Conditioners - NC	heat pump, air cooled, 65,000-135,000 BTUH, 47db/43wb	1	1991	Coefficient of Performance	>2.8
Central Air Conditioners - NC	heat pump, air cooled, <65,000 BTUH, single package	1	1991	Heating Seasonal Performance Factor	>6.6
Central Air Conditioners - NC	heat pump, air cooled, <65,000 BTUH, single package	1	1992	Heating Seasonal Performance Factor	>6.6
Central Air Conditioners - NC	heat pump, air cooled, <65,000 BTUH, single package	1	1993	Heating Seasonal Performance Factor	>6.6
Central Air Conditioners - NC	heat pump, air cooled, <65,000 BTUH, split system	1	1991	Heating Seasonal Performance Factor	>6.6

Appliance Efficiency Matrix

Federal and California Efficiency Standards

Appliance	Type	Effective Date		Rating	Rating
		Month	Year	Parameter	Value
Central Air Conditioners - NC	heat pump, air cooled, <65,000 BTUH, split system	1	1992	Heating Seasonal Performance Factor	>6.8
Central Air Conditioners - NC	heat pump, air cooled, <65,000 BTUH, split system	1	1993	Heating Seasonal Performance Factor	>6.8
Central Air Conditioners - NC	heat pumps, air cooled, 65,000-135,000 BTUH, 17db/14wb	1	1991	Coefficient of Performance	>1.9
Central Air Conditioners - NC	heat pumps, air cooled, 65,000-135,000 BTUH, 47db/43wb	1	1992	Coefficient of Performance	>2.0
Central Air Conditioners - NC	heat pumps, air cooled, 65,000-135,000 BTUH, 47db/43wb	1	1992	Coefficient of Performance	>3.0
Central Air Conditioners - NC	heat pumps, air cooled, 65,000-135,000 BTUH, 47db/43wb	1	1993	Coefficient of Performance	>2.0
Central Air Conditioners - NC	heat pumps, air cooled, 65,000-135,000 BTUH, 47db/43wb	1	1993	Coefficient of Performance	>3.0
Central Furnaces	<225,000 BTUH	1	1991	Annual Fuel Utilization Efficiency	>68%
Central Furnaces	<225,000 BTUH	1	1992	Annual Fuel Utilization Efficiency	>78%
Central Furnaces	>225,000 BTUH, max rated capacity	1	1991	Thermal Efficiency	>75%
Central Furnaces	>225,000 BTUH, max rated capacity	1	1992	Thermal Efficiency	>80%
Central Furnaces	>225,000 BTUH, min rated capacity	1	1991	Thermal Efficiency	>72%
Central Furnaces	>225,000 BTUH, min rated capacity	1	1992	Thermal Efficiency	>78%
Central Furnaces	duct furnaces, max rated capacity	12	1983	Thermal Efficiency	>80%
Central Furnaces	duct furnaces, min rated capacity	1	1991	Thermal Efficiency	>72%
Central Furnaces	duct furnaces, min rated capacity	1	1992	Thermal Efficiency	>75%
Central Furnaces	duct furnaces, standby	1	1983	Energy Consumption	<10W
Central Furnaces	duct furnaces, standby, LPG	1	1983	Energy Consumption	<147W
Central Furnaces	unit heaters, max rated capacity	12	1983	Thermal Efficiency	>80%
Central Furnaces	unit heaters, min rated capacity	1	1991	Thermal Efficiency	>72%
Central Furnaces	unit heaters, min rated capacity	1	1992	Thermal Efficiency	>74%
Central Furnaces	unit heaters, standby	12	1983	Energy Consumption	<10W
Central Furnaces	unit heaters, standby, LPG	12	1983	Energy Consumption	<147W
Central Furnaces	all	7	1978	Intermittent Ignition Device	Present
Central Furnaces	fan type, for mobile homes	9	1990	Intermittent Ignition Device	Present
Central Furnaces	fan type, not for mobile homes	1	1992	Intermittent Ignition Device	Present
Central Furnaces - NC	<225,000 BTUH	1	1991	Annual Fuel Utilization Efficiency	>68%
Central Furnaces - NC	<225,000 BTUH	1	1992	Annual Fuel Utilization Efficiency	>78%
Central Furnaces - NC	>225,000 BTUH, max rated capacity	1	1991	Thermal Efficiency	>75%
Central Furnaces - NC	>225,000 BTUH, max rated capacity	1	1992	Thermal Efficiency	>80%
Central Furnaces - NC	>225,000 BTUH, min rated capacity	1	1991	Thermal Efficiency	>72%
Central Furnaces - NC	>225,000 BTUH, min rated capacity	1	1992	Thermal Efficiency	>78%
Central Furnaces - NC	duct furnaces, max rated capacity	12	1983	Thermal Efficiency	>80%
Central Furnaces - NC	duct furnaces, min rated capacity	1	1991	Thermal Efficiency	>72%
Central Furnaces - NC	duct furnaces, min rated capacity	1	1992	Thermal Efficiency	>75%
Central Furnaces - NC	duct furnaces, standby	1	1983	Energy Consumption	<10W
Central Furnaces - NC	duct furnaces, standby, LPG	1	1983	Energy Consumption	<147W
Central Furnaces - NC	unit heaters, max rated capacity	12	1983	Thermal Efficiency	>80%
Central Furnaces - NC	unit heaters, min rated capacity	1	1991	Thermal Efficiency	>72%
Central Furnaces - NC	unit heaters, min rated capacity	1	1992	Thermal Efficiency	>74%
Central Furnaces - NC	unit heaters, standby	12	1983	Energy Consumption	<10W
Central Furnaces - NC	unit heaters, standby, LPG	12	1983	Energy Consumption	<147W
Central Heat Pumps	central AC/heat-pumps	12	1978	Coefficient of Performance	>2.2@47F,1.2@17F,2.2@70FH2O
Central Heat Pumps	central AC/heat-pumps	12	1979	Coefficient of Performance	>2.5@47F,1.5@17F,2.5@70FH2O
Clothes Dryers	electric, compact (<4.4 cuft capacity), 120volt	5	1994	Energy Factor (lbs/kWh)	>3.13
Clothes Dryers	electric, compact (<4.4 cuft capacity), 240volt	5	1994	Energy Factor (lbs/kWh)	>2.90
Clothes Dryers	electric, standard (>4.4 cuft capacity)	5	1994	Energy Factor (lbs/kWh)	>3.01
Clothes Dryers	gas	5	1994	Energy Factor (lbs/kWh)	>2.67
Clothes Dryers	all	2	1979	Intermittent ignition devices	Present
Clothes Washers	all	1	1988	Unheated Water Rinse Option	Present
Clothes Washers	top load, <1.6cuft capacity	5	1994	Energy Factor (cuft/kWh/cycle)	>.90
Clothes Washers	top load, <1.6cuft capacity	5	1994	Energy Factor (cuft/kWh/cycle)	>.90
Clothes Washers	top load, >1.6cuft capacity	5	1994	Energy Factor (cuft/kWh/cycle)	>1.18
Dishwashers	all	1	1988	Air Dry Option	Present

Appliance Efficiency Matrix
Federal and California Efficiency Standards

Appliance	Type	Effective Date		Rating	Rating
		Month	Year	Parameter	Value
Dishwashers	compact, <22" exterior width	5	1994	Energy Factor (cycles/kWh)	>.62
Dishwashers	standard, >22" exterior width	5	1994	Energy Factor (cycles/kWh)	>.46
Electric Heaters	duct furnaces	12	1980	Thermal Efficiency & Standby loss	>77%,<10W
Electric Heaters	duct furnaces	12	1983	Thermal Efficiency & Standby loss	>80%,<10W
Electric Heaters	unit heaters	12	1980	Thermal Efficiency & Standby loss	>77%,<10W
Electric Heaters	unit heaters	12	1983	Thermal Efficiency & Standby loss	>80%,<10W
Electric Water Heaters	all storage types	7	1993	Standby Loss	<.30+27/V
Electric Water Heaters	large, storage type	1	1990	Standby Loss	<4W/SF or 35W
Electric Water Heaters	mobile home storage type	12	1978	Standby Loss	<4W/sqft
Electric Water Heaters	non mobile home storage type	12	1978	Standby Loss	<35W or 4W/sqft
Electric Water Heaters	instantaneous, <12kW, <4000 BTUH/gal	4	1991	Energy Factor	>.93-(.00132V)
Electric Water Heaters	storage type, >12kW	4	1991	Energy Factor	>.93-(.00132V)
Electric Water Heaters - NC	small, >20 gal	1	1990	Energy Factor	>.93-(.00132V)
Freezers	chest	1	1987	Annual Energy Consumption	<14.8V+384
Freezers	chest and all other	1	1990	Annual Energy Consumption	<14.8(AV)+223
Freezers	chest and all other	1	1993	Annual Energy Consumption	<11.0(AV)+160
Freezers	man defrost	11	1979	Energy Consumption (kWh/month)	<40+4V
Freezers	upright auto defrost	11	1979	Energy Consumption (kWh/month)	<40+6V
Freezers	upright auto defrost	1	1987	Annual Energy Consumption	<33.7V+755
Freezers	upright auto defrost	1	1990	Annual Energy Consumption	<16.0(AV)+623
Freezers	upright auto defrost	1	1993	Annual Energy Consumption	<14.9(AV)+391
Freezers	upright man defrost	1	1987	Annual Energy Consumption	<21.4V+480
Freezers	upright man defrost	1	1990	Annual Energy Consumption	<10.9(AV)+422 AV=1.73(freezer cuft)
Freezers	upright man defrost	1	1993	Annual Energy Consumption	<10.3(AV)+264 AV=1.73(freezer cuft)
Freezers - NC	chest	1	1992	Annual Energy Consumption	<10.9V+282
Freezers - NC	upright auto defrost	1	1992	Annual Energy Consumption	<21.3V+477
Freezers - NC	upright man defrost	1	1992	Annual Energy Consumption	<14.5V+324
Gas Pool Heaters	all	1	1990	Intermittent Ignition Device	Presence
Gas Space Heaters	floor fan	12	1978	Thermal Efficiency & Standby loss	>70%,<10W
Gas Space Heaters	floor gravity	12	1978	Thermal Efficiency & Standby loss	>65%,<147W
Gas Space Heaters	floor, <37,000 BTUH	1	1987	Seasonal Efficiency	>56%
Gas Space Heaters	floor, >37,000 BTUH	1	1987	Seasonal Efficiency	>57%
Gas Space Heaters	furnace >45,000 BTUH, non-mobile home	1	1992	Annual Fuel Utilization Efficiency	>78%
Gas Space Heaters	gas steam boiler	1	1992	Annual Fuel Utilization Efficiency	>75%
Gas Space Heaters	mobile home furnaces	9	1990	Annual Fuel Utilization Efficiency	>75%
Gas Space Heaters	non-gas steam boilers	1	1992	Annual Fuel Utilization Efficiency	>80%
Gas Space Heaters	room <20,000 BTUH	12	1978	Thermal Efficiency & Standby loss	>65%,<147W
Gas Space Heaters	room >20,000 BTUH	12	1978	Thermal Efficiency & Standby loss	>70%,<147W
Gas Space Heaters	room, 18,000-20,000 BTUH	1	1987	Seasonal Efficiency	>58%
Gas Space Heaters	room, 20,000-27,000 BTUH	1	1987	Seasonal Efficiency	>63%
Gas Space Heaters	room, 27,000-46,000 BTUH	1	1987	Seasonal Efficiency	>64%
Gas Space Heaters	room, <18,000 BTUH	1	1987	Seasonal Efficiency	>57%
Gas Space Heaters	room, >46,000 BTUH	1	1987	Seasonal Efficiency	>65%
Gas Space Heaters	wall fan	12	1978	Thermal Efficiency & Standby loss	>77%,<10W
Gas Space Heaters	wall fan	12	1981	Thermal Efficiency & Standby loss	>80%,<10W
Gas Space Heaters	wall fan type, <42,000 BTUH	1	1987	Seasonal Efficiency	>73%
Gas Space Heaters	wall fan type, >42,000 BTUH	1	1987	Seasonal Efficiency	>74%
Gas Space Heaters	wall furnaces	12	1979	Intermittent Ignition Device	Present
Gas Space Heaters	wall gravity	12	1978	Thermal Efficiency & Standby loss	>70%,<147W
Gas Space Heaters	wall gravity type, 10,000-12,000 BTUH	1	1987	Seasonal Efficiency	>60%
Gas Space Heaters	wall gravity type, 12,000-15,000 BTUH	1	1987	Seasonal Efficiency	>61%
Gas Space Heaters	wall gravity type, 15,000-19,000	1	1987	Seasonal Efficiency	>62%
Gas Space Heaters	wall gravity type, 19,000-27,000	1	1987	Seasonal Efficiency	>63%
Gas Space Heaters	wall gravity type, 27,000-46,000 BTUH	1	1987	Seasonal Efficiency	>64%

Appliance Efficiency Matrix

Federal and California Efficiency Standards

Appliance	Type	Effective Date		Rating	Rating
		Month	Year	Parameter	Value
Gas Space Heaters	wall gravity type, <10,000 BTUH	1	1987	Seasonal Efficiency	>59%
Gas Space Heaters	wall gravity type, >46,000 BTUH	1	1987	Seasonal Efficiency	>65%
Gas Space Heaters - NC	floor, <37,000 BTUH	1	1990	Seasonal Efficiency	>56%
Gas Space Heaters - NC	floor, >37,000 BTUH	1	1990	Seasonal Efficiency	>57%
Gas Space Heaters - NC	non-weatherized fan type central furnaces	1	1988	Seasonal Efficiency	>72%
Gas Space Heaters - NC	room, 18,000-20,000 BTUH	1	1990	Seasonal Efficiency	>58%
Gas Space Heaters - NC	room, 20,000-27,000 BTUH	1	1990	Seasonal Efficiency	>63%
Gas Space Heaters - NC	room, 27,000-46,000 BTUH	1	1990	Seasonal Efficiency	>64%
Gas Space Heaters - NC	room, <18,000 BTUH	1	1990	Seasonal Efficiency	>57%
Gas Space Heaters - NC	room, >46,000 BTUH	1	1990	Seasonal Efficiency	>65%
Gas Space Heaters - NC	wall fan type, <42,000 BTUH	1	1990	Seasonal Efficiency	>73%
Gas Space Heaters - NC	wall fan type, >42,000 BTUH	1	1990	Seasonal Efficiency	>74%
Gas Space Heaters - NC	wall gravity type, 10,000-12,000 BTUH	1	1990	Seasonal Efficiency	>60%
Gas Space Heaters - NC	wall gravity type, 12,000-15,000 BTUH	1	1990	Seasonal Efficiency	>61%
Gas Space Heaters - NC	wall gravity type, 15,000-19,000	1	1990	Seasonal Efficiency	>62%
Gas Space Heaters - NC	wall gravity type, 19,000-27,000	1	1990	Seasonal Efficiency	>63%
Gas Space Heaters - NC	wall gravity type, 27,000-46,000 BTUH	1	1990	Seasonal Efficiency	>64%
Gas Space Heaters - NC	wall gravity type, <10,000 BTUH	1	1990	Seasonal Efficiency	>59%
Gas Space Heaters - NC	wall gravity type, >46,000 BTUH	1	1990	Seasonal Efficiency	>65%
Gas Space Heaters - NC	weatherized fan type central furnaces	1	1988	Seasonal Efficiency	>71%
Gas Water Heaters	<155,000 BTUH,<10 gal, >4000 BTUH/gal	9	1992	Thermal Efficiency	>80%
Gas Water Heaters	<155,000 BTUH,<10 gal, >4000 BTUH/gal	7	1993	Thermal Efficiency	>80%
Gas Water Heaters	<155,000 BTUH,<4000 BTUH/gal	9	1992	Standby Loss & Thermal Efficiency	<1.3+114/V, >78%
Gas Water Heaters	<155,000 BTUH,<4000 BTUH/gal	7	1993	Standby Loss & Thermal Efficiency	<1.3+114/V, >78%
Gas Water Heaters	<155,000 BTUH,>10 gal, >4000 BTUH/gal	9	1992	Standby Loss & Thermal Efficiency	<2.3+67/V, >77%
Gas Water Heaters	<155,000 BTUH,>10 gal, >4000 BTUH/gal	7	1993	Standby Loss & Thermal Efficiency	<2.3+67/V, >77%
Gas Water Heaters	>155,000 BTUH,<4000 BTUH/gal	9	1992	Standby Loss & Thermal Efficiency	<1.3+95/V, >78%
Gas Water Heaters	>155,000 BTUH,<4000 BTUH/gal	7	1993	Standby Loss & Thermal Efficiency	<1.3+95/V, >78%
Gas Water Heaters	all others	12	1978	Thermal Efficiency	>75%
Gas Water Heaters	all others	4	1981	Thermal Efficiency	<75%
Gas Water Heaters	alternate standard	12	1978	Thermal Efficiency & Standby Loss	>74%,<1.3+67/gallons
Gas Water Heaters	alternate standard	12	1979	Thermal Efficiency & Standby Loss	>74%,<1.3+67/gallons
Gas Water Heaters	instantaneous, <200,000 BTUH, <4000 BTUH/gal	4	1991	Energy Factor	>.62-(.0019V)
Gas Water Heaters	large, instantaneous type	1	1990	Thermal Efficiency	<75%
Gas Water Heaters	large, storage type	4	1981	Standby Loss & Thermal Efficiency	<2.3+67/V%, >76%
Gas Water Heaters	large, storage type	1	1990	Standby Loss & Thermal Efficiency	<2.3+67/V%, >76%
Gas Water Heaters	mobile home 25-35 gallons	12	1978	Thermal Efficiency & Standby Loss	>75%,<7.0%
Gas Water Heaters	mobile home < 25 gallon	12	1978	Thermal Efficiency & Standby Loss	>75%,<7.5%
Gas Water Heaters	mobile home > 35 gallons	12	1978	Thermal Efficiency & Standby Loss	>75%,<6.0%
Gas Water Heaters	mobile home, 25-35 gallon	4	1981	Standby Loss & Recovery Efficiency	<7.0%,75%
Gas Water Heaters	mobile home, <25 gallon	4	1981	Standby Loss & Recovery Efficiency	<7.5%,75%
Gas Water Heaters	mobile home, >35 gallon	4	1981	Standby Loss & Recovery Efficiency	<6.0%,75%
Gas Water Heaters	small storage, not mobile home	4	1981	Standby Loss & Recovery Efficiency	<2.3+67/V%,>76%
Gas Water Heaters	small storage, not mobile, alternative	4	1981	Standby Loss & Recovery Efficiency	<1.3+67/V%,>74%
Gas Water Heaters	storage type <4ft high	12	1978	Thermal Efficiency & Standby Loss	>74%,<2.3+67/gallons
Gas Water Heaters	storage type <4ft high	12	1979	Thermal Efficiency & Standby Loss	>76%,<2.3+67/gallons
Gas Water Heaters	storage type >4ft high	12	1978	Thermal Efficiency & Standby Loss	>76%,<2.3+67/gallons
Gas Water Heaters	storage type, >75,000 BTUH	4	1991	Energy Factor	>.62-(.0019V)
Gas Water Heaters - NC	small, >20 gal	1	1990	Energy Factor	>.62-(.0019V)
Household Cooking	all non-LPG	7	1978	Intermittent Ignition Device	Present
Household Cooking	all non-LPG	1	1990	Intermittent Ignition Device	Present
Lamp Ballasts	one F40T12 lamp, 120 volt	6	1983	Ballast Efficiency Factor	>1.805
Lamp Ballasts	one F40T12 lamp, 120 volt	6	1983	Ballast Efficiency Factor	>1.805
Lamp Ballasts	one F40T12 lamp, 277 volt	6	1983	Ballast Efficiency Factor	>1.805

Appliance Efficiency Matrix
Federal and California Efficiency Standards

Appliance	Type	Effective Date		Rating	Rating
		Month	Year	Parameter	Value
Lamp Ballasts	two F40T12 lamp, 120 volt	6	1983	Ballast Efficiency Factor	>1.060
Lamp Ballasts	two F40T12 lamp, 277 volt	6	1983	Ballast Efficiency Factor	>1.050
Lamp Ballasts	two F96T12 lamp, 120 volt	6	1983	Ballast Efficiency Factor	>.570
Lamp Ballasts	two F96T12 lamp, 277 volt	6	1983	Ballast Efficiency Factor	>.570
Lamp Ballasts	two F96T12HO lamps, 120 volt	1	1990	Ballast Efficacy Factor	>.390
Lamp Ballasts	two F96T12HO lamps, 277 volt	1	1990	Ballast Efficacy Factor	>.390
Lavatory Faucets	all	12	1978	Maximum Flow Rate (gpm)	<2.75
Lavatory Faucets	all	3	1992	Maximum Flow Rate (gpm)	<2.2
Motors	single speed, polyphase, Group A: 1-4 hp	1	1989	Minimum Rated Efficiency (%)	<77.0
Motors	single speed, polyphase, Group A: 1-4 hp	1	1992	Minimum Rated Efficiency (%)	<78.5
Motors	single speed, polyphase, Group B: 5-9 hp	1	1989	Minimum Rated Efficiency (%)	<82.5
Motors	single speed, polyphase, Group B: 5-9 hp	1	1992	Minimum Rated Efficiency (%)	<84.0
Motors	single speed, polyphase, Group C: 10-19 hp	1	1989	Minimum Rated Efficiency (%)	<84.0
Motors	single speed, polyphase, Group C: 10-19 hp	1	1992	Minimum Rated Efficiency (%)	<85.5
Motors	single speed, polyphase, Group D: 20-49 hp	1	1989	Minimum Rated Efficiency (%)	<87.5
Motors	single speed, polyphase, Group D: 20-49 hp	1	1992	Minimum Rated Efficiency (%)	<88.5
Motors	single speed, polyphase, Group E: 50-99 hp	1	1989	Minimum Rated Efficiency (%)	<89.5
Motors	single speed, polyphase, Group E: 50-99 hp	1	1992	Minimum Rated Efficiency (%)	<90.2
Motors	single speed, polyphase, Group F: 100-124 hp	1	1989	Minimum Rated Efficiency (%)	<91.0
Motors	single speed, polyphase, Group F: 100-124 hp	1	1992	Minimum Rated Efficiency (%)	<91.7
Motors	single speed, polyphase, Group G: 125 or greater hp	1	1989	Minimum Rated Efficiency (%)	<91.7
Motors	single speed, polyphase, Group G: 125 or greater hp	1	1992	Minimum Rated Efficiency (%)	<92.4
Oil Water Heaters	<155,000 BTUH, <4,000 BTUH/gal	7	1993	Standby Loss & Thermal Efficiency	<1.3+114/V, >78%
Oil Water Heaters	>155,000 BTUH, <10 gal, >4,000 BTUH/gal	7	1993	Thermal Efficiency	>80%
Oil Water Heaters	>155,000 BTUH, <4,000 BTUH/gal	7	1993	Standby Loss & Thermal Efficiency	<1.3+95/V, >78%
Oil Water Heaters	>155,000 BTUH, >10 gal, >4,000 BTUH/gal	7	1993	Standby Loss & Thermal Efficiency	<2.3+67/V, >77%
Oil Water Heaters	instantaneous, <210,000 BTUH, <4000 BTUH/gal	4	1991	Energy Factor	>.59-(.0019V)
Oil Water Heaters	storage type, >105,000 BTUH	4	1991	Energy Factor	>.59-(.0019V)
Oil Water Heaters - NC	small, >20 gal	1	1990	Energy Factor	>.59-(.0019V)
Refrigerator-Freezers	>9 cuft manual defrost	1	1987	Annual Energy Consumption	<24.7(AV)+486
Refrigerator-Freezers	>9 cuft part auto defrost	1	1987	Annual Energy Consumption	<24.7(AV)+486
Refrigerator-Freezers	>9 cuft, auto defrost, bottom freezer	1	1987	Annual Energy Consumption	<30.3(AV)+535
Refrigerator-Freezers	>9 cuft, auto defrost, side freezer	1	1987	Annual Energy Consumption	<30.3(AV)+535
Refrigerator-Freezers	>9 cuft, auto defrost, side freezer, door ice service	1	1987	Annual Energy Consumption	<33.6(AV)+594
Refrigerator-Freezers	>9 cuft, auto defrost, top freezer	1	1987	Annual Energy Consumption	<24.1(AV)+487
Refrigerator-Freezers	>9 cuft, auto defrost, top freezer, door ice service	1	1987	Annual Energy Consumption	<26.8(AV)+540
Refrigerator-Freezers	all <9 cuft	1	1987	Annual Energy Consumption	<24.7(AV)+486
Refrigerator-Freezers	auto defrost	11	1977	Energy Consumption (kWh/month)	<40+7V
Refrigerator-Freezers	auto defrost	11	1979	Energy Consumption (kWh/month)	<40+5V
Refrigerator-Freezers	auto defrost, bottom freezer	1	1990	Annual Energy Consumption	<27.7(AV)+488
Refrigerator-Freezers	auto defrost, bottom freezer	1	1993	Annual Energy Consumption	<16.5(AV)+367
Refrigerator-Freezers	auto defrost, side freezer	1	1990	Annual Energy Consumption	<27.7(AV)+488
Refrigerator-Freezers	auto defrost, side freezer	1	1993	Annual Energy Consumption	<11.8(AV)+501
Refrigerator-Freezers	auto defrost, side freezer, door ice service	1	1990	Annual Energy Consumption	<30.9(AV)+547
Refrigerator-Freezers	auto defrost, side freezer, door ice service	1	1993	Annual Energy Consumption	<16.3(AV)+527
Refrigerator-Freezers	auto defrost, top freezer	1	1990	Annual Energy Consumption	<23.5(AV)+471
Refrigerator-Freezers	auto defrost, top freezer	1	1993	Annual Energy Consumption	<16.0(AV)+355
Refrigerator-Freezers	auto defrost, top freezer, door ice service	1	1990	Annual Energy Consumption	<26.4(AV)+535
Refrigerator-Freezers	auto defrost, top freezer, door ice service	1	1993	Annual Energy Consumption	<17.6(AV)+391
Refrigerator-Freezers	man defrost	11	1977	Energy Consumption (kWh/month)	<40+5V
Refrigerator-Freezers	man defrost	11	1979	Energy Consumption (kWh/month)	<40+4V
Refrigerator-Freezers	manual defrost	1	1990	Annual Energy Consumption	<16.3(AV)+316
Refrigerator-Freezers	manual defrost	1	1993	Annual Energy Consumption	<13.5(AV)+299
Refrigerator-Freezers	part auto defrost	1	1990	Annual Energy Consumption	<21.8(AV)+429

Appliance Efficiency Matrix
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Appliance	Type	Effective Date		Rating	Rating
		Month	Year	Parameter	Value
Refrigerator-Freezers	part auto defrost	1	1993	Annual Energy Consumption	<10.4(AV)+398
Refrigerator-Freezers - NC	>9 cuft manual defrost	1	1992	Annual Energy Consumption	<17.4(AV)+344
Refrigerator-Freezers - NC	>9 cuft part auto defrost	1	1992	Annual Energy Consumption	<17.4(AV)+344
Refrigerator-Freezers - NC	>9 cuft, auto defrost, bottom freezer	1	1992	Annual Energy Consumption	<22.4(AV)+395
Refrigerator-Freezers - NC	>9 cuft, auto defrost, side freezer	1	1992	Annual Energy Consumption	<22.4(AV)+395
Refrigerator-Freezers - NC	>9 cuft, auto defrost, side freezer, door ice service	1	1992	Annual Energy Consumption	<24.8(AV)+438
Refrigerator-Freezers - NC	>9 cuft, auto defrost, top freezer	1	1992	Annual Energy Consumption	<16.7(AV)+336
Refrigerator-Freezers - NC	>9 cuft, auto defrost, top freezer, door ice service	1	1992	Annual Energy Consumption	<18.5(AV)+374
Refrigerator-Freezers - NC	all <9 cuft	1	1992	Annual Energy Consumption	<17.4(AV)+344
Refrigerators	all w/o freezers	11	1977	Energy Consumption (kWh/month)	<40+2.5V(volume in cubic feet)
Refrigerators	all w/o freezers	11	1979	Energy Consumption (kWh/month)	<40+2.5V
Refrigerators	man & partial auto defrost	1	1987	Annual Energy Consumption	<17.3(AV)+340 AV=1.63(freezer cuft)+ref. cuft
Refrigerators	manual defrost	1	1990	Annual Energy Consumption	<16.3(AV)+316 AV=1.44(freezer cuft)+ref. cuft
Refrigerators	manual defrost	1	1993	Annual Energy Consumption	<13.5(AV)+299 AV=1.44(freezer cuft)+ref. cuft
Refrigerators - NC	man & partial auto defrost	1	1992	Annual Energy Consumption	<13.7(AV)+267 AV=1.63(freezer cuft)+ref. cuft
Room Air Conditioners	>200 volt supply	11	1979	Energy Efficiency Ratio	>8.2
Room Air Conditioners	>200 volt supply	1	1990	Energy Efficiency Ratio	>8.2
Room Air Conditioners	cooling BTU/hr > 20,000	11	1977	Energy Efficiency Ratio	>7.0
Room Air Conditioners	non heat-pump < 200 volt	11	1979	Energy Efficiency Ratio	>8.7
Room Air Conditioners	non heat-pump < 200 volt	1	1990	Energy Efficiency Ratio	>8.7
Room Air Conditioners	non heat-pump<20,000 BTUH	11	1977	Energy Efficiency Ratio	>7.5
Room Air Conditioners	other heat pumps	11	1977	Energy Efficiency Ratio	>7.1
Room Air Conditioners	other heat pumps	11	1979	Energy Efficiency Ratio	>8.3
Room Air Conditioners	other heat pumps	1	1990	Energy Efficiency Ratio	>8.3
Room Air Conditioners	rev cycle, louvered side	1	1990	Energy Efficiency Ratio	>8.5
Room Air Conditioners	rev cycle, w/o louvered side	1	1990	Energy Efficiency Ratio	>8.0
Room Air Conditioners	w/o rev cycle, louvered side, 14000-19999 BTUH	1	1990	Energy Efficiency Ratio	>8.8
Room Air Conditioners	w/o rev cycle, louvered side, 6000-7999 BTUH	1	1990	Energy Efficiency Ratio	>8.5
Room Air Conditioners	w/o rev cycle, louvered side, 8000-13999 BTUH	1	1990	Energy Efficiency Ratio	>9.0
Room Air Conditioners	w/o rev cycle, louvered side, <6000 BTUH	1	1990	Energy Efficiency Ratio	>8.0
Room Air Conditioners	w/o rev cycle, louvered side, >20,000 BTUH	1	1990	Energy Efficiency Ratio	>8.2
Room Air Conditioners	w/o rev cycle, w/o louvered side, 14000-19999 BTUH	1	1990	Energy Efficiency Ratio	>8.5
Room Air Conditioners	w/o rev cycle, w/o louvered side, 6000-7999 BTUH	1	1990	Energy Efficiency Ratio	>8.5
Room Air Conditioners	w/o rev cycle, w/o louvered side, 8000-13999 BTUH	1	1990	Energy Efficiency Ratio	>8.5
Room Air Conditioners	w/o rev cycle, w/o louvered side, <6000 BTUH	1	1990	Energy Efficiency Ratio	>8.0
Room Air Conditioners	w/o rev cycle, w/o louvered side, >20,000 BTUH	1	1990	Energy Efficiency Ratio	>8.2
Room Air Conditioners - NC	packaged terminal heat pumps	1	1991	Coefficient of Performance	>1.3+.16(EER)
Room Air Conditioners - NC	packaged terminal air conditioners	1	1991	Energy Efficiency Ratio	>10.0-.19(CAP)/1000 @95db and >12.0-.23(CAP)/1000 @82db
Room Air Conditioners - NC	packaged terminal air conditioners	1	1992	Energy Efficiency Ratio	>10.0-.16(CAP)/1000 @95db and >12.2-.20(CAP)/1000 @82db
Room Air Conditioners - NC	packaged terminal heat pumps	1	1991	Energy Efficiency Ratio	>10.0-.19(CAP)/1000 @95db and >12.0-.23(CAP)/1000 @82db
Room Air Conditioners - NC	packaged terminal heat pumps	1	1992	Energy Efficiency Ratio	>10.0-.16(CAP)/1000 @95db and >12.2-.20(CAP)/1000 @82db
Showerheads	all	12	1978	Maximum Flow Rate (gpm)	<2.75
Showerheads	all	3	1992	Maximum Flow Rate (gpm)	<2.5
Sink Faucets	all	12	1978	Maximum Flow Rate (gpm)	<2.75
Sink Faucets	all	3	1992	Maximum Flow Rate (gpm)	<2.2
Swimming Pool Heaters	all	2	1984	Intermittent Ignition Device	Present
Tub Spout Diverters	after 15,000 divert cycles	3	1992	Maximum Flow Rate (gpm)	<.3
Tub Spout Diverters	new	3	1992	Maximum Flow Rate (gpm)	<.1

Appendix B

Efficiency Measure Matrix

This appendix contains a matrix listing the efficiency measures offered by PG&E, SCE, SDG&E, and SoCal Gas during 1993, as indicated in filings to the California Public Utilities Commission. The measures are sorted according to the affected end-use, affected fuel, measure category, and measure name. For each measure the matrix indicates the utility and customer sectors that apply.

The first column of the matrix lists "affected end-uses", and may contain any one of the following energy end-use categories: 1) domestic hot water (DHW), 2) heating, ventilating, and air conditioning (HVAC), 3) lighting (LIGHTS), 4) electric motors (MOTORS), 5) other (OTHER), and 6) refrigeration (REF). The measure categories indicated in the fourth column include: 1) controls, 2) equipment, 3) insulation, 4) maintenance, and 5) shell. Shell measures include all items that affect the building envelope, such as windows, doors, wall and ceiling insulation. The customer sectors are: residential (R), commercial (C), industrial (I), and agricultural (A). These categories are compatible with those developed for the California Conservation Inventory, although some of the detailed energy end-use which appear in the inventory have been aggregated. The last column indicates which if any appliance standards has bearing on the energy savings attributable to the program listed.

Efficiency Measure Matrix (1993 Programs)

Affected End Use	Affected Fuel		Measure Category	Measure Name	Utility/Customer Sector																								Applicable Appliance Standard
					PG&E								SCE								SDG&E								SoCal Gas							
					New				Retro				New				Retro				New				Retro				New				Retro			
	Gas	Elec			R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	
DHW		x	Controls	EMS for water heating																					x	x										None
DHW		x	Equipment	Chemical dishwashers														x																		Dishwashers
DHW		x	Equipment	Efficient water heater					x																x	x	x									Water Heater
DHW		x	Equipment	Fine bubble diffusers																					x	x										None
DHW		x	Equipment	Heat pump water heater									x			x		x																		Heat Pumps
DHW		x	Equipment	Showerhead replacement					x																x											Showerheads
DHW		x	Equipment	Water saving flapper													x																			None
DHW		x	Insulation	Water heater wrap					x																											Water Heaters
DHW	x		Equipment	Central Heater																									x				x			Space Heaters
DHW	x		Equipment	Faucet Aerators																													x	x	x	Sink Faucets
DHW	x		Equipment	Showerhead					x																x								x			Showerheads
DHW	x		Equipment	Water heater efficiency upgrade																	x								x				x		x	Water Heaters
DHW	x		Insulation	Pipe insulation					x																								x	x	x	None
DHW	x		Insulation	Water heater wrap					x																								x	x	x	Water Heaters
DHW	x		Maintenance	Maintenance																													x			None
HVAC		x	Controls	Bypass controls						x																										None
HVAC		x	Controls	CO2 sensor		x																														None
HVAC		x	Controls	Clock thermostat						x							x																			None
HVAC		x	Controls	Cooling EMS																															x	None
HVAC		x	Controls	DDC for cooling																																None
HVAC		x	Controls	Heating EMS																															x	None
HVAC		x	Equipment	Air conditioner efficiency upgrade										x			x			x	x				x	x	x									Air Conditioners
HVAC		x	Equipment	Air cooled packaged AC upgrade		x																														Air Conditioners
HVAC		x	Equipment	Built-up cooling systems upgrade		x																														Air Conditioners
HVAC		x	Equipment	Central AC system upgrade					x	x																										Air Conditioners
HVAC		x	Equipment	Chiller efficiency upgrade						x				x				x				x				x	x									Air Conditioners
HVAC		x	Equipment	Compresser/Condenser Improvement																						x										Air Conditioners
HVAC		x	Equipment	Constant volume efficiency upgrade		x																														None
HVAC		x	Equipment	Cooling tower efficiency upgrade						x																	x									None
HVAC		x	Equipment	Dessicant dehumidifiers																						x										None
HVAC		x	Equipment	Direct evaporative cooler						x																										None
HVAC		x	Equipment	Economizer																		x				x	x	x								None
HVAC		x	Equipment	Evaporative condenser						x																										None
HVAC		x	Equipment	Evaporative cooler					x								x																			None
HVAC		x	Equipment	Evaporative cooler covers													x																			Non

Efficiency Measure Matrix (1993 Programs)

Affected End Use	Affected Fuel		Measure Category	Measure Name	Utility/Customer Sector																										Applicable Appliance Standard
					PG&E								SCE								SDG&E								SoCal Gas				
					New				Retro				New				Retro				New				Retro				New				Retro			
	Gas	Elec			R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	
HVAC		x	Equipment	Exhaust dampers													x																None
HVAC		x	Equipment	Heat pump - air source upgrade		x								x			x		x	x		x				x				x				Heat Pumps
HVAC		x	Equipment	Heating efficiency upgrade																													Space Heaters
HVAC		x	Equipment	Motor efficiency upgrade																													None
HVAC		x	Equipment	Packaged terminal units upgrade						x																							Air Conditioners
HVAC		x	Equipment	Remote condensers						x																							Air Conditioners
HVAC		x	Equipment	VAV systems		x																											None
HVAC		x	Equipment	Variable frequency drives																													None
HVAC		x	Equipment	Water cooled packaged AC upgrade		x																											Air Conditioners
HVAC		x	Equipment	Water source heat-pump		x																											Heat Pumps
HVAC		x	Equipment	Whole house fan													x																None
HVAC		x	Insulation	Duct insulation					x																								None
HVAC		x	Maintenance	AC Maintenance					x								x	x	x														Air Conditioners
HVAC		x	Maintenance	HVAC filter replacement					x																								None
HVAC		x	Maintenance	Heat pump maintenance					x																								Heat Pumps
HVAC		x	Maintenance	Register sealing													x																None
HVAC		x	Shell	Automatic door																													None
HVAC		x	Shell	Ceiling insulation	x				x								x	x	x	x					x								None
HVAC		x	Shell	Double walled polyethylene								x																					None
HVAC		x	Shell	Floor insulation	x				x								x								x								None
HVAC		x	Shell	Glazing	x	x								x			x					x			x								None
HVAC		x	Shell	Infiltration reduction													x																None
HVAC		x	Shell	Mini blinds																	x												None
HVAC		x	Shell	Sun screens																					x								None
HVAC		x	Shell	Thermal night curtain								x																					None
HVAC		x	Shell	Wall insulation					x									x	x	x													None
HVAC		x	Shell	Window treatment														x	x							x							None
HVAC	x		Equipment	Boiler wrap																					x								Boilers
HVAC	x		Equipment	Economizer																						x							None
HVAC	x		Equipment	Furnace efficiency upgrade					x												x	x							x		x				Space Heaters
HVAC	x		Equipment	Furnace replacement																					x						x				Space Heaters
HVAC	x		Equipment	Gas driven heat-pump					x																										Heat Pumps
HVAC	x		Equipment	Heating equipment replacement																									x				x		x	x	Space Heaters
HVAC	x		Insulation	Ceiling insulation																					x								x	x	x	x	None
HVAC	x		Insulation	Duct insulation					x																x								x				None

Efficiency Measure Matrix (1993 Programs)

Affected End Use	Affected Fuel		Measure Category	Measure Name	Utility/Customer Sector																										Applicable Appliance Standard
					PG&E								SCE								SDG&E								SoCal Gas				
					New				Retro				New				Retro				New				Retro				New				Retro				
	Gas	Elec			R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	
HVAC	x		Insulation	Wall insulation																									x								None
HVAC	x		Maintenance	Building envelope repair																					x								x				None
HVAC	x		Maintenance	Filter																					x												None
HVAC	x		Maintenance	Maintenance																					x								x				None
HVAC	x		Shell	Outlet gaskets																													x				None
HVAC	x		Shell	Weatherstripping																					x								x				None
HVAC	x		Shell	Window glazing																													x				None
LIGHTS		x	Controls	Daylighting									x					x	x			x					x										None
LIGHTS		x	Controls	Lighting control improvement		x				x			x									x						x	x								None
LIGHTS		x	Equipment	Ballast efficiency upgrade		x				x			x									x						x	x	x							Lamp Ballasts
LIGHTS		x	Equipment	Fixture upgrade/replacement						x							x	x	x	x					x	x	x	x									None
LIGHTS		x	Equipment	Lamp efficiency improvement					x	x							x					x			x	x	x	x									None
LIGHTS		x	Maintenance	Lumen maintenance		x																															None
MOTORS		x	Controls	Adjustable speed drive for compressor		x				x																											None
MOTORS		x	Controls	CO monitors																							x										None
MOTORS		x	Controls	Timeclock for motors														x																			None
MOTORS		x	Controls	Variable speed drives		x				x			x					x	x	x		x					x	x	x								None
MOTORS		x	Equipment	Motor efficiency upgrade		x				x			x						x	x		x					x	x	x								None
Other		x	Controls	EMS for process heat																								x	x								None
Other		x	Controls	Timeclock with battery								x							x	x																	None
Other		x	Equipment	Air amplifiers																								x									None
Other		x	Equipment	Boarding machine																								x									None
Other		x	Equipment	Clothes washers					x																												Clothes Washers
Other		x	Equipment	Coffee machine insulation						x																											None
Other		x	Equipment	Cooking efficiency upgrade																										x							Household Cooking
Other		x	Equipment	Injection molders																								x									None
Other		x	Equipment	Jensen press																							x										None
Other		x	Equipment	Low loss transformers		x																															None
Other		x	Equipment	Low pressure sprinklers								x																									None
Other		x	Equipment	Process heat																							x	x	x								None
Other		x	Equipment	Pump efficiency upgrade								x																	x								None
Other		x	Equipment	Surge valves								x																									None
Other		x	Equipment	Well water measurement device								x																									None
Other		x	Maintenance	Pump adjustment								x																									None
Other	?	?	Equipment	Gas broiler to griddle replacement						x																											Household Cooking

Efficiency Measure Matrix (1993 Programs)

Affected End Use	Affected Fuel		Measure Category	Measure Name	Utility/Customer Sector																				Applicable Appliance Standard
					PG&E								SCE								SDG&E				SoCal Gas				
					New				Retro				New				Retro				New				New				
	Gas	Elec			R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	
Other	?	?	Equipment	Hot top range replacement						x																			Household Cooking
Other	x		Controls	Pilotless ignitors					x																				Household Cooking
Other	x		Controls	Timeclocks					x																				None
Other	x	x	Equipment	Clothes dryers					x																				Clothes Dryers
Other	x		Equipment	Combined space/water heaters																					x				Space Heaters
Other	x	x	Equipment	Cooking conversion					x																				Household Cooking
Other	x		Equipment	Dryer replacement																								x	Clothes Dryers
Other	x		Equipment	Dual mode steamer						x																			None
Other	x		Equipment	Fryer insulation						x																			None
Other	x		Equipment	Furnace/kiln/oven replacement																								x	Space Heaters
Other	x		Equipment	Heat recovery																								x	None
Other	x		Equipment	Process cooking replacement																								x	None
Other	x		Equipment	Replace boiler																								x	Boilers
Other	x		Equipment	Replace gas engine																									None
Other	x		Equipment	Thermal oxidizer																									None
Other	x		Maintenance	Combustion efficiency adjustment																									Boilers
Other	x		Maintenance	Range maintenance																									Household Cooking
REF		x	Controls	Condensate evaporator controls						x																			None
REF		x	Controls	EMS for refrigeration																									None
REF		x	Controls	Walk-in occupancy sensor						x																			None
REF		x	Equipment	Air cooled condenser		x																							None
REF		x	Equipment	Antisweat controls						x																			None
REF		x	Equipment	Auto closers						x																			None
REF		x	Equipment	Beer cooler efficiency upgrade																									None
REF		x	Equipment	Case lighting		x																							None
REF		x	Equipment	Compressor efficiency upgrade																									Air Conditioners
REF		x	Equipment	Display case covers						x																			None
REF		x	Equipment	Door gaskets						x																			None
REF		x	Equipment	Electric condensate evaporator						x																			None
REF		x	Equipment	Electronic ballast display case						x																			Lamp Ballasts
REF		x	Equipment	Evaporater efficiency upgrade						x																			None
REF		x	Equipment	Evaporative condenser		x																							None
REF		x	Equipment	Evaporative condensers																									None
REF		x	Equipment	Fan motors efficiency upgrade		x																							None
REF		x	Equipment	Floating head pressure		x				x																			None

Efficiency Measure Matrix (1993 Programs)

Affected End Use	Affected Fuel		Measure Category	Measure Name	Utility/Customer Sector																								Applicable Appliance Standard
					PG&E								SCE								SDG&E								SoCal Gas							
					New				Retro				New				Retro				New				Retro				New				Retro			
	Gas	Elec			R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	R	C	I	A	
REF		x	Equipment	Freezer efficiency upgrade					x																												Freezers
REF		x	Equipment	Glass or acrylic doors						x																											None
REF		x	Equipment	Heat exchanger								x																									None
REF		x	Equipment	Heatless doors						x																											None
REF		x	Equipment	High capacity condensers						x																											None
REF		x	Equipment	Hot gas defrost																								x									None
REF		x	Equipment	Low temp doors		x																															None
REF		x	Equipment	Medium temp doors		x																															None
REF		x	Equipment	Milk pre-cooler								x																									None
REF		x	Equipment	Multiplex compressor		x				x																											None
REF		x	Equipment	New case with doors						x																											None
REF		x	Equipment	Refrigerator efficiency upgrade					x								x								x	x	x	x									Refrigerator
REF		x	Equipment	Strip curtains for walk-in						x																											None
REF		x	Equipment	Subcoolers						x																											None
REF		x	Insulation	Suction line insulation						x																											None
REF		x	Maintenance	Maintenance																					x												None