Consortium for Energy Efficiency

Commercial Kitchens Initiative

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1 Background

The foodservice market consists of the most energy-intensive commercial buildings, consuming roughly 2.5 times more energy per square foot than other commercial buildings. In addition, this market is also a large consumer of water and generator of wastewater and solid waste. To address this market, the Commercial Refrigeration Initiative was approved by the CEE Board of Directors in December 2002 including specifications for refrigerators, freezers and ice-makers. Based upon program experience, initiative participants agreed that program participation can be increased by expanding the initiative to include a suite of offerings relevant to the foodservice sector thereby creating a commercial kitchens focus. As a result, the CEE Commercial Kitchens Initiative was developed.

The purpose of this initiative is to provide clear and credible definitions in the marketplace as to what constitutes highly efficient energy and water performance in cooking, refrigeration and sanitation equipment and then to help streamline the selection of products through a targeted market strategy based upon the unique features of a particular foodservice market (e.g. restaurants) within foodservice.

2 Introduction

The foodservice market includes sectors that vary from restaurants to lodging to institutional cafeterias. These sectors differ in many ways including decision making channels as well as equipment considerations. To successfully impact this water and energy-intense area, this initiative intends to capture the value of national consistency in the definition of energy and water efficient products through voluntary specifications and/or application guides and to effectively reach key market sectors through detailed program design strategy templates.

This initiative will become host to a series of application specific performance specifications for use in commercial kitchen settings. As performance specifications are adopted for additional technologies they will be added to the Initiative.

Table 1 - Target technologies for Initiative launch.

Category	Technology	Specification or Application Guide	Savings Potential (%)		
			Water	Gas	Electric
Cooking	Fryers	Specification similar to ENERGY STAR	---	25-35%	5-10%
	Steamers	Specification similar to ENERGY STAR; includes additional water efficiency criteria	90%	30-40%	30-50%
	Hot Food Holding Cabinets	Specification similar to ENERGY STAR	---	---	55-65%
Refrigeration	Ice Machines (cubers)	Specification for Tier 1 (same as EPAct 2005), 2 and 3	20-40%	---	15-30%
	Solid Door Reach In Refrigerators	Specification for Tier 1 (same as EPAct 2005) and 2	---	---	25-55%

	Solid Door Reach In Freezers	Specification for Tier 1 (same as EPAct 2005) and 2	---	---	30-50%
	Glass Door Reach In Freezers	Specification for Tier 1 (same as EPAct 2005) and 2	---	---	10-30%
Sanitation	Pre-Rinse Spray Valves	Application Guide	30-60%	30-60%	30-60%
	Dishwashers	Specification similar to ENERGY STAR	30-50%	30-50%	30-50%

The specifications included in this Initiative have been reviewed and modified as appropriate based upon industry review and comment. Industry is supportive of the resulting Initiative and encourages the pursuit of additional application specific specifications.

A critical aspect of this effort is the importance of forging working relationships between CEE members administering energy efficiency programs, water agencies, manufacturers and key associations. Due to the significance of the added water savings achievable with various technologies, initiative participation has been expanded to include sponsoring water agencies. In addition, by working with staff from the ENERGY STAR program, an on-going relationship is ensured that encourages that CEE efforts and those of ENERGY STAR are complementary. CEE will work with ENERGY STAR to make certain that any performance specification is consistent with Commercial Kitchen Sponsors and their program needs.

2.1 Goal and Strategy

The immediate strategy for this initiative is to nationally align definitions around efficient products relevant to a sector of considerable impact within the foodservice market. By starting with a targeted sector in terms of savings potential, relevance, and prevalent customer type members can justify investments of time and program-development attention and work to build a critical mass of support across the country.

CEE's broad strategies to accomplish this include:

- Research opportunities for additional energy and water savings opportunities in commercial kitchens and develop water/energy equipment specifications.
- Initiate and/or strengthen relationships with key stakeholders, including manufacturers, trade associations, and key end-user associations.
- Increase specification use in programs through promotion and exploration of various program approaches and how they can meet various program objectives

To work towards these strategies, concurrent efforts were established focusing on technology assessment and market strategy.

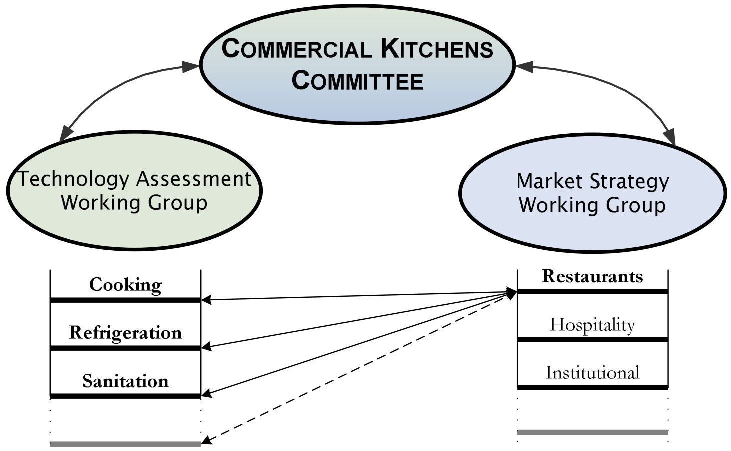

Figure 1 - Strategy to address commercial kitchens markets and technologies.

3 Food Service Overview

The foodservice market can be broken down into commercial and non-commercial categories. Seventy four percent of sales in this market fall under the commercial category, which is the focus of this Initiative. Categories within commercial foodservice include fast food (quick service) and full service restaurants with further breakdowns based upon whether or not the establishment is independently owned and operated or part of a chain.

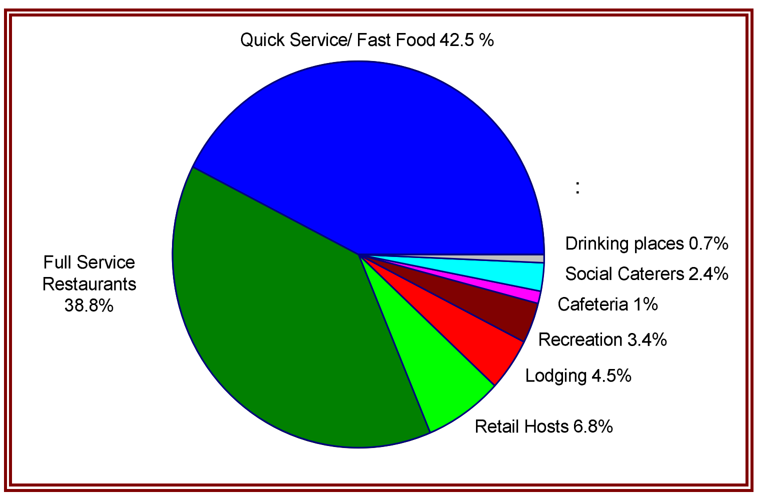

Figure 2 – Commercial Foodservice Sales by Market Sector, 2000.

3.1 Food Service Opportunity

CEE has been involved in this complex, dynamic, and growing market since 2002, with the launch of the commercial refrigeration initiative. Data indicates there is significant opportunity for water and energy efficiency in this area, as food service is the most energy-intensive market out of commercial buildings. In 1999, commercial buildings dedicated to foodservice used 241,200 BTU/sq. ft., while the closest end use used 202,000 BTU/sq. ft. Figure 3 gives a graphic illustration of the relative energy intensity by building activity.

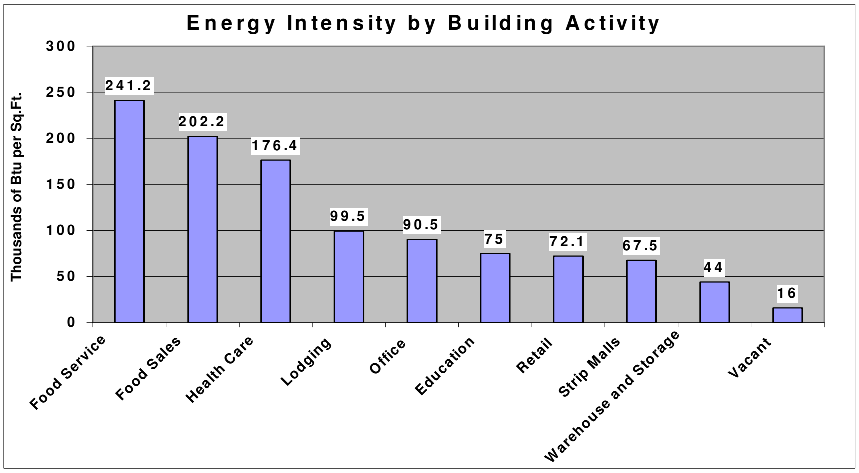

Figure 3 - Energy intensity by buildings use.

3.2 Food Service Trends

Several trends are influencing the commercial foodservice market overall, and have important repercussions for energy and water use in this area. These include:

- *Growth*: The percentage of the food dollar spent on food consumption outside of the home has been increasing ever since the 1930s and may rise to 53% by 2010.
- *Consolidation*: Between 1972 and 1992, commercial foodservice concentration almost doubled. Franchising continues to dominate quick service establishments, and is making inroads in full service establishments. Consolidation impacts both the level at which decisions are made and the impact of those decisions.
- *Increased use of technology*: New appliances can bake faster, activate pre-set cooking programs, and use computer networks to communicate with each other or to the outside regarding needed supplies or repairs. These technologies could lead to changes such as increased efficiency and different skill sets for foodservice workers.

4 Market Strategy

Based upon the complexity of the foodservice market, the CEE Commercial Kitchens Committee decided to develop a market strategy for a single sector with the intent to evaluate additional segments over time. The restaurants sector was selected for initial investigation from a program strategy perspective. This decision was primarily made due to the relative size of this category compared to other categories in commercial foodservice and the resulting potential for impact. This sector accounts for 67% of sales in the foodservice sector.

4.1 Restaurants

Restaurants are experiencing strong growth within the commercial foodservice market, doubling in the US to 858,000 between 1974 and 2004. Restaurants spend approximately $14.3 Billion to $23.8 Billion annually for gas, electricity and water. These facilities fall into two main categories: full service and quick service. Full service is defined as serving prepared foods and beverages where the patron is seated, with wait staff assistance, and where payment comes after eating. Quick or limited service restaurants are defined as having a restricted selection of food which is served to eat on the premises, nearby, or at the consumer's home.

4.1.1 Independently Owned vs. Franchised Facility

In order to effectively outreach to various types of restaurants whether they are quick service or full service, it is important to understand the differences between an independently owned facility and a franchised chain facility. Eight out of ten full service restaurants are independently owned establishments where each owner makes decisions about their kitchen appliances. Restaurants within a franchising system can be owned by the parent company (chain-owned franchise) or owned by others (franchisee-owned). The parent chain in a franchise can choose to operate all, none, or a portion of their branches. Even if the franchisee owns his or her establishment and is involved in decision making, the parent chain retains considerable power.

Key points in how decisions are made by independent and franchised facilities include:

- Buy-in from top level decision makers is important in the franchise market. However, due to the number of market players, these top-level decision makers should include representatives from the many industry groups that communicate with chain owners.
- Fragmented decision making within chains pose serious barriers to promoting energy and water efficiency. By finding a "champion" within an organization, efficiency messages can be widely heard through many departments.
- Owners have several concerns that could be potentially addressed through efficiency, including labor, safety, and atmosphere. These additional concerns should not be neglected and can be used as an opening for education opportunities.
- Franchised chains present market barriers that can be mitigated by approaching the right decision-makers with the right message, building trusted partnerships with national organizations, and through well-publicized pilot projects.
- Independent owners present different market barriers that may be lessened by providing easy access to reliable equipment performance data and/or custom incentives for attractive technologies. A bundled approach that includes promoting efficient lighting as well as other cooking or refrigeration technologies can complement program offerings.
- Independent owners rely on industry partners such as dealers, distributors, manufacturers' representatives, and service agents for equipment information and recommendations. Independent owners can effectively be reached through partnerships with these industry stakeholders.
- Working with associations on both a national and regional level can help create a unified message that will reach many stakeholders.

5 Technology Assessment

In order to define high performance in the Commercial Kitchens market, CEE's Initiative will include performance specifications for those technologies with verified savings and impact as well as relevance to the selected targeted market of restaurants. As seen in Figure 4, while lighting and HVAC are typically the dominant energy consuming end uses, the foodservice sector offers an opportunity for a variety of innovative technologies for cooking, sanitation and refrigeration. This initiative will focus on these three areas while understanding that innovations in efficient lighting and HVAC technologies/practices can be incorporated through existing long standing programs.

In order to assess the various technologies, a matrix of equipment relevant to the foodservice market was created and categorized by cooking, refrigeration and sanitation use. A host of measures was identified based upon a list of criteria expanding upon the CEE Initiative Development Process. This list includes:

- Relevance to the foodservice market sector under evaluation (e.g. restaurants)
- Savings potential in electric, gas and water consumption
- Level of effort required to develop a significant performance specification
- Consideration of the existence of national, state, and local codes and standards
- Relevance of technology to other foodservice sectors

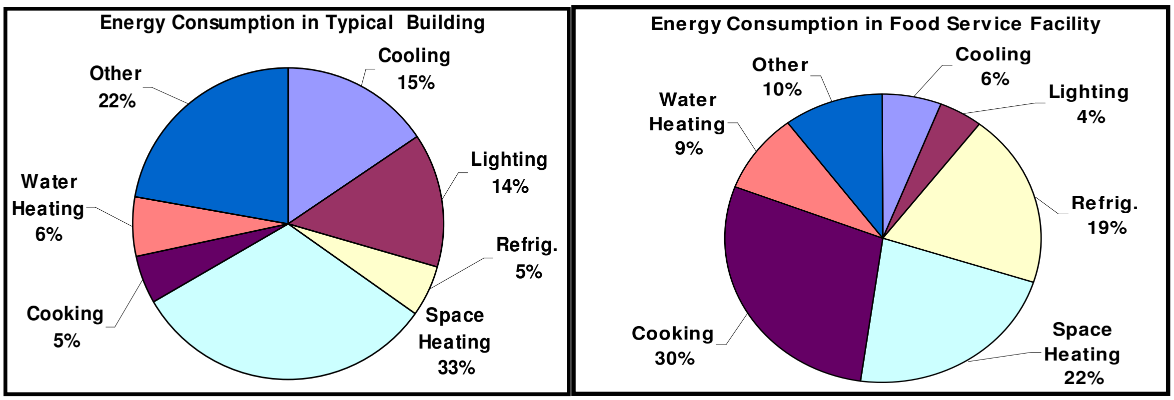

Figure 4 - Energy consumption comparison.

5.1 Cooking

Cooking and baking equipment accounts for the largest energy consuming end use in the foodservice market. The most commonly found equipment within this category includes fryers, convection ovens, broilers, and griddles. The majority of cooking and baking equipment installed in the US is natural gas operated. A broader list of typical equipment covered in this category is given in Table 2 with typical annual consumption values as well as potential savings percentages.

Table 2 - Cooking technologies relevant to the restaurants sector.

		~Annual Consumption			~Savings Potential (%)		
Equipment	**Life (yrs)**	**W (10^3 Gal.)**	**G (Mbtu)**	**E (MWh)**	**W**	**G**	**E**
Broilers	7-15		160-200	18-22		25-35%	25-35%
Fryers	8		100-150	10-12		25-35%	5-10%
Griddles	7-15		100-120	16-18		10-20%	5-10%
Hot Food Holding Cabinets	15			5-6			55-65%

Convection Ovens	7-15		90-120	20-22		10-30%	10-20%
Range Tops	8-10		120	11		30-40%	15-30%
Steam Cookers	10	140-160	150-300	25-50	90%	30-40%	30-50%

More detailed information on equipment categories for which specifications have been developed follows.

5.1.1 Open-Deep Fat Fryers

Commercial electric and gas fryers with varying energy performance levels are currently available in the market. The three common types of fryers are open-deep fat fryers, pressure/kettle fryers and flat-bottom specialty fryers. The key parameters in identifying performance for fryers are:

- Cooking Energy Efficiency – ratio of energy added to the food to the total energy supplied to the fryer during cooking.
- Idle Energy Rate (Btu/hr) – rate of appliance energy consumption while frying at stabilized operating conditions.

In early 2004, ENERGY STAR launched a specification for the most commonly found, Open-Deep Fat Fryers (also known as French Fryers). Thus far, ENERGY STAR has reported that approximately 7 percent of fryer shipments were ENERGY STAR-qualified in 2004 (approx. 7,000 units). While the ENERGY STAR label has been out for some time, members report that availability of products meeting these criteria is an issue at the local and regional level.

After reviewing the ENERGY STAR criteria, the CEE Commercial Kitchens Committee decided to develop a specification with matching criteria (see Table 3) for the Initiative with recommendations that will include efforts to engage fryer manufacturers and distributors to address the availability and accessibility of qualifying products. Aligning the CEE specification with ENERGY STAR will help establish new programs in the market. In the future, a second, higher performance specification can be assessed as well as whether or not to include other types of fryers, such as larger sized fryers.

Table 3 - CEE specification for High Efficiency Gas and Electric Open-Deep Fat French Fryers.

Energy Efficiency Requirements for Open Deep-Fat Gas Fryers	
Heavy Load Cooking Energy Efficiency	≥ 50%
Idle Energy Rate	≤ 9,000 Btu/hr*
Energy Efficiency Requirements for Open Deep-Fat Electric Fryers	
Heavy Load Cooking Energy Efficiency	≥ 80%
Idle Energy Rate	≤ 1000 watts*

** Based on 15-inch nominal width fryer*

5.1.1.1 Market Availability

There are a number of fryer manufacturers in the United States; major manufacturers include Frymaster LLC, Henny Penny Corp, Hobart Corp., Keating of Chicago, Inc., Pitco Frialator Inc., and UltraFryer Systems Inc. According to ENERGY STAR, six fryer manufacturers currently provide a total of 31 qualifying high efficiency fryer products (20 electric fryers and 11 gas fryers). Figure 5 illustrates the number of products available at various performance levels that meet the specification criteria.

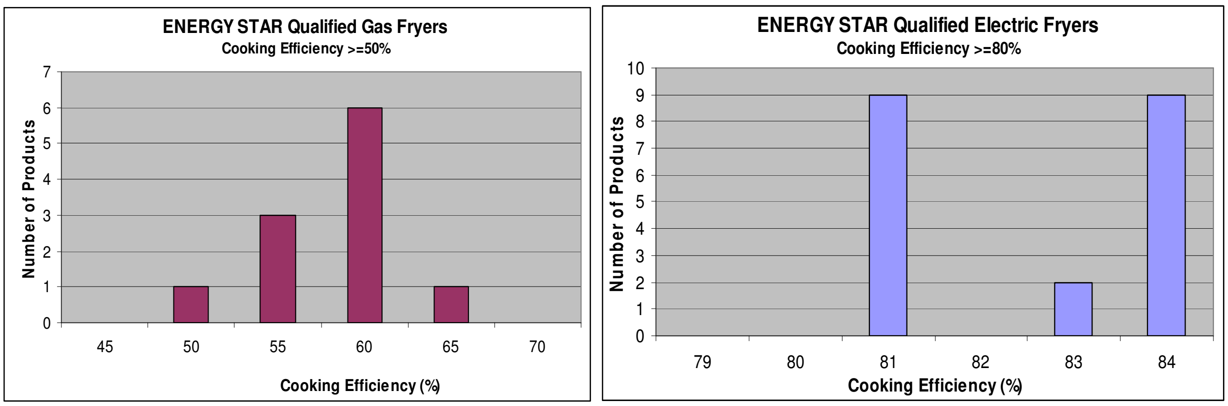

Figure 5 - Equipment availability by performance.

The incremental cost differential between standard fryers and high efficiency fryers is quite substantial. A standard gas fryer lists from $1,500 to $2,000 and a typical high-efficiency fryer lists from $3,000 to $3,500. On the other hand a standard electric fryer lists from $500 to $1,000 with a high efficiency electric fryer ranging from $1,000 to $1,500. Manufacturers claim that high-efficiency fryers have additional benefits due to their robust design and components.

5.1.1.2 Energy Savings Potential

While the high efficiency fryers specification addresses electric and gas fryers, a 1989 NAFEM survey indicates that 80% of the deep-fat fryers used in commercial food service are gas fired. ENERGY STAR estimates that a high efficiency gas fryer can save businesses 28 MBtu annually, or average of $185/year on utility bills while a high efficiency electric fryer can save 879 kWh annually, or an average of $60/year on utility bills. Table 4 and Table 5 provide an economic analysis using the Fryer Life-Cycle Cost Calculator available at www.fishnick.com..

Table 4 - High efficiency gas fryer energy savings.*

	Standard Fryer	High Efficiency Fryer	Savings
Idle Energy Rate (Btu/hr)	14,000	9,000	5,000
Heavy Load Energy Efficiency (%)	35%	50%	15%
Annual Energy Consumption (therms)	1,100	808	292
Annual Energy Cost ($)	1,100	808	292

Table 5 - High efficiency electric fryer energy savings.*

	Standard Fryer	High Efficiency Fryer	Savings
Idle Energy Rate (kW)	1.0	0.95	0.05
Heavy Load Energy Efficiency (%)	75	82.4	7.4
Annual Energy Consumption (kWh)	13,072	12,048	1,024
Annual Energy Cost ($)	1,307	1,205	102

****Analysis assumes a 12-hour operating day and average energy costs of 10¢/kWh and $1.00/therm.***

5.1.2 Commercial Steam Cookers

Promoting efficient commercial steam cookers can save on water, gas and electric consumption. This type of equipment is also found is almost all types of restaurants; both full service and quick service. Commercial steamers can come in many configurations including counter-top, wall-mounted, and floor models. Key differences in commercial steamers are defined by how they generate steam. One method is to use a boiler that can either deliver pressurized steam through adjusting control settings or deliver pressureless steam with an open condensate drain to the compartment(s). Another method is to use a steam generator which is located in the cooking cavity. Steam is delivered either through an external steam line or it can be produced by using boiling water directly in the cavity. This latter process is referred to as “connectionless”. These three types of machines can vary in design features. The key parameters in identifying performance for steam cookers are:

- Cooking Energy Efficiency – ratio of energy added to the food to the total energy supplied to the steam cooker during cooking.
- Idle Energy Rate (Btu/hr) – rate of appliance energy consumption while steaming.
- Water consumption (gal/hr) – the quantity of water used to cook potatoes during the ASTM Standard Test Method for Performance of Steam Cookers (F1484).

In early 2004, ENERGY STAR launched a specification for Commercial Steam Cookers. This specification applies to electric and gas Steam Cookers. The specification defines Commercial Steam Cookers as “a device with one or more food steaming compartments in which the energy in the steam is transferred to the food by direct contact”.

Based upon a review of the ENERGY STAR requirement for Commercial Steam Cookers, the CEE Commercial Kitchens Committee developed a specification with the same electric and gas criterion as ENERGY STAR (see Table 6) with the addition of a water consumption parameter. In addition to including a water consumption parameter, two tier levels were defined; Tier 1A and Tier 1B. These tiers are distinguished by different water consumption limits to recognize the technical capabilities of different types of steam cookers. While the ENERGY STAR label does not distinguish between categories of steam cookers, there are vast performance differences in water consumption for boiler-based steam cookers and the pressure-less systems. While alignment with ENERGY STAR will help establish new programs in the market, the committee wanted to make sure that these technical limitations were taken into consideration.

Table 6 -CEE specification for Commercial Steam Cookers

Pan Capacity	Cooking Energy Efficiency (%)*		Specification	Corresponding Base Specification (Idle Energy Rate only)	Idle Energy Rate		Water Consumption (gal/hour)*
	Gas	Electric			Gas (btu/hour)	Electric (watts)	
3-pan	≥38%	≥50%	CEE Tier 1A	ENERGY STAR®	≤6,250	≤400	≤15
4-pan	≥38%	≥50%	CEE Tier 1B	ENERGY STAR	≤8,350	≤530	≤4
5-pan	≥38%	≥50%	CEE Tier 1A	ENERGY STAR	≤10,400	≤670	≤15
6-pan +	≥38%	≥50%	CEE Tier 1B	ENERGY STAR	≤12,500	≤800	≤4

**Cooking Energy Efficiency and Water Consumption are based on heavy load (potato) cooking test*

5.1.2.1 Market Availability

There are a number of steam cooker manufacturers in the United States; major manufacturers include Accutemp Products, AGA Foodservice/Stellar Steam, Cleveland Range, Intek Manufacturing, Market Forge, Unified Brands and Vulcan-Hart/Hobart. As of June 2008, there were 71 products representing 11 manufacturers that qualify under these requirements. Sixty-eight of the products are electric and the remaining three are gas. In 2004, 3000 ENERGY STAR qualified steamers were sold. This is roughly 10% of the total units sold in a year. However, almost all of these products are connectionless products and meet both Tier 1A and Tier 1B requirements.

There is no incremental cost difference between a typical convection steamer and a more efficient connectionless steamer. In fact, the cost for a more efficient connectionless steamer is roughly $2,000 less. However, at the time of this report, boiler-based systems are improving in design and may be able to meet some of the efficiency levels defined in the specification. The cost difference between these new and improved boiler-based systems is not available at this time.

5.1.2.2 Energy Savings Potential

As discussed above, connectionless/pressure-less steamers are inherently more energy efficient based upon their design. A typical forced convection steamer with a separate steam generator will consume 11,600 kWh per year while a similar connectionless steamer will only use 4,980 kWh per year to perform the same amount of work. Table 7 and Table 8 provide an economic analysis using the Steam Cooker Life-Cycle Cost Calculator available at www.fishnick.com.

Table 7- High efficiency 3-pan gas steamer energy savings.*

	Standard Boiler-Based	Connectionless	Savings
Idle Energy Rate (Btu/hr)	6,000	6,000	5,000
Water Consumption (gal/hr)	40	4	36
Heavy Load Energy Efficiency (%)	15%	38%	---
Annual Energy Consumption (therms)	999	362	637
Annual Water Consumption (gal)	175,200	17,520	157680
Annual Energy Cost ($)	999	362	637
Annual Water Cost ($)	1171	117	1054

Table 8 – High efficiency 3-pan electric steamer energy savings.*

	Standard Boiler-Based	Connectionless	Savings
Idle Energy Rate (kW)	1.0	0.4	0.6
Water Consumption (gal/hr)	40	3	36
Heavy Load Energy Efficiency (%)	26	50	---
Annual Energy Consumption (kWh)	15,287	3,532	11,755
Annual Water Consumption (gal)	175,200	13,140	162,060
Annual Energy Cost ($)	1529	353	1176
Annual Water Cost ($)	1171	88	1083

**Analysis assumes a 12-hour operating day and average energy costs of 10¢/kWh, $1.00/therm and water/sewer $5/ccf.*

5.1.3 Hot Food Holding Cabinets

Hot food holding cabinets are found in commercial and non-commercial kitchens such as restaurants and cafeterias where there is a need to keep prepared foods hot prior to serving. ENERGY STAR defines them as “an appliance designed to hold hot food at a specified temperature, which has been cooked using a separate appliance”. As a result of the significant savings opportunities, energy efficient hot food holding cabinets have been recently promoted at both the regional and national level. In 2004, ENERGY STAR set a performance requirement of less than or equal to 40 watts/cu-ft. In California, state appliance standards for hot food holding cabinets went into effect on January 1, 2006 at this ENERGY STAR level. Therefore California efficiency programs have adopted a more stringent maximum idle rate of 20 watt/cu-ft. Based upon this development, two tier levels have been developed for this equipment as seen in Table 9.

Table 9- CEE Hot Food Holding Cabinets Specification

Equipment	CEE Specification	Corresponding Base Specification	Maximum Idle Energy Use (watts/cu-ft)
Hot Food Holding Cabinets	Tier 1	ENERGY STAR	40
	Tier 2	ENERGY STAR + 50%	20

5.1.3.1 Market Availability

According to the NAFEM database of equipment manufacturers, there are 23 manufacturers of hot food holding cabinets of which 15 of meet the efficiency criteria above as of June 2008. Some of these manufacturers include Alto-Shaam, Inc., Carter-Hoffmann, Crescor, Food Warming Equipment Company, Inc., Hatco Corporation, and Henny Penny. As of June 2008, 124 product families qualify at Tier 1 and 69 at Tier 2. In 2004, 12,000 ENERGY STAR qualified hot food holding cabinets were sold. This is roughly 10% of the total units sold in a year. Depending upon the features and capacity, hot food holding cabinets can vary in price from $1,800 to $3,500. While more efficient models will be slightly higher in first cost, the payback period from the energy savings realized can vary from 1.5 to 2.5 years.

5.1.3.2 Energy Savings Potential

Significant energy savings in electricity can be realized in hot food holding cabinets by design attributes that include insulation in the cabinet walls, controls for temperature and humidity and doors that can be used without losing heat (i.e. Dutch Doors). A typical full sized hot food holding cabinet is around 20 cu-ft. A standard non-insulated hot food holding cabinet has an idle energy rate of roughly 75 watts/cu-ft or 1,500 kW. A more efficient model can range in idle energy use from 20-40 watts/cu-ft or 400 kW to 800 kW. A typical non-insulated unit will consume approximately 8,300 kWh per year, based on an average use of 15 hours per day. If left on overnight, the energy use can increase to 13,280 kWh per year. Table 10 provides an economic analysis using the Hot Food Holding Cabinet Life-Cycle Cost Calculator available at www.fishnick.com.

Table 10 - High efficiency 20 cu-ft hot food holding cabinet energy savings.

	Standard Unit	Tier 1 Qualifying Unit	Tier 2 Qualifying Unit
Idle Energy Rate (watts/cu-ft)	70	40	20
Annual Energy Consumption (kW)	7665	4380	2190
Annual Energy Cost ($)	767	438	219

5.2 Refrigeration

Refrigeration is the third highest energy consuming end use in foodservice facilities following space heating. Most of the equipment found in the foodservice market in this category relate to commercial packaged refrigerators, freezers and ice-makers. Table **11** provides a listing of the annual consumption and savings potential in this category or equipment.

Table 11 - Refrigeration technologies relevant to the restaurants sector.

Equipment		Life (yrs)	~Annual Consumption W (10^3 Gal.)	~Annual Consumption G (Mbtu)	~Annual Consumption E (MWh)	~Savings Potential (%) W	~Savings Potential (%) G	~Savings Potential (%) E
Reach-In Freezers	Solid Door	9-10			8-10			10-30%
	Glass Door	9-10			16-20			10-30%
Ice Machines	Cube	8-10	150-200		4-8	20-40%		15-30%
	Nugget	8-10	80-100		3-7	40-50%		30-60%
Reach-In Refrigerators	Solid Door	9-10			3-4			25-55%
	Glass Door	9-10			5-8			30-50%

The specifications included in this category include: solid door refrigerators and freezers, glass door refrigerators and ice "cube making" machines. Initially, CEE addressed these technologies in the CEE Commercial Refrigeration Initiative; however, with the expanded participation by water agencies, these specifications have been re-evaluated with consideration to water consumption and product availability.

5.2.1 Reach-In Refrigerators and Freezers

CEE launched an initiative for commercial reach-in, solid-door commercial refrigerators and freezers in December of 2002. Reach-in, solid-door refrigerators and freezers are used in the food service industry by restaurants and institutional organizations, accounting for approximately 17 percent of all commercial refrigeration energy use. In December 2003, CEE launched an initiative for high-efficiency commercial glass-door, reach-in refrigerators. Glass-door refrigerators (which accounts for 8 percent of packaged commercial refrigeration energy use) are frequently used as beverage merchandisers, although they also have commercial kitchen applications. Currently, there are no CEE efficiency specifications for glass-door reach in freezers. The committee will consider the inclusion of a specification to address this technology in the future.

In the Energy Policy Act of 2005, CEE Tier 1 levels for solid door refrigerators and freezers, glass-door refrigerators and ice-makers were adopted as the federal minimum in 2010. However, states including California, Massachusetts and New York will be adopting these standards earlier in 2008. The committee will consider these activities when re-evaluating these tier levels in the future.

Table 12 and Table 13 provide the current specification levels for solid door reach-in refrigerators and freezers as well as glass door reach in refrigerators. These specifications were not modified for inclusion in this Initiative.

Table 12 - CEE specification for solid door reach-in refrigerators and freezers.

Solid-Door Equipment	Specification	Corresponding Base Specification	Maximum Daily Energy Use (kWh/day)
Refrigerator	CEE Tier 1	ENERGY STAR	.10V + 2.04
	CEE Tier 2	ENERGY STAR + 40%	.06V + 1.22
Freezer	CEE Tier 1	ENERGY STAR	.40V + 1.38
	CEE Tier 2	ENERGY STAR + 30%	.28V + .97

Table 13 - CEE specification for glass door reach in refrigerators.

Glass-Door Equipment	Specification	Corresponding Base Specification	Maximum Daily Energy Use (kWh/day)
Refrigerator	CEE Tier 1	25% of top performing products.	.12V + 3.34
	CEE Tier 2	28% more efficient than Tier 1.	.086V + 2.39

5.2.1.1 Market Availability

The standard line of products for solid door reach-in refrigerators and freezers tend to be less expensive and is primarily sold to commercial food establishments. These represent 70 percent of the total market. The primary manufacturers for this equipment are True (20 percent market share), Beverage Air (12 percent), Delfield (12 percent), Hobart (6 percent), McCall (6 percent) and Glenco-Star (4 percent). Other manufacturers make up the remaining 40 percent including the emergence of reach in products for scientific laboratory usage. As of June 2008 there were 134 products representing 13 manufacturers that meet CEE’s Tier 2 for solid door refrigerators and 207 products representing 17 manufacturers that meet CEE’s Tier 2 for solid door freezers.

There are two dominant manufacturers for glass door reach in refrigerators: True and Beverage-Air. Each has approximately 45 percent of the market share. The rest of the market is divided among a large number of small manufacturers, such as Delfield, Victory, and Stevens-Lee. Nationally, an estimated 800,000 units are in place, using 4.7 billion kWh annually. As of June 2008 there were 336 products representing 23 manufacturers that meet CEE’s Tier 1 and 119 products representing 16 manufacturers that meet CEE’s Tier 2.

5.2.1.2 Energy Savings Opportunities

In 1996, the average energy use of a solid-door, reach-in freezer was 7,500 kWh per year, with a potential increase in efficiency of 30 percent (less than a two-year payback). The average energy use of a solid-door, reach-in refrigerator was 3,800 kWh per year, with a potential increase in efficiency of 35 percent (also less than a two-year payback). Substantial efficiency gains are also possible for glass-door models. A 1996 Arthur D. Little study identified opportunities for per-unit savings on reach-in glass door refrigerators as 45 percent, with a potential payback of 2.2 years or less.

Table 14 compares the energy savings seen between a standard model and a high efficiency model as proposed by CEE Tier 1 and Tier 2.

Table 14 - Energy savings available with CEE Tiers for efficient Commercial Refrigerators and Freezers.

Capacity (cu-ft)	Base Case Annual Energy Use	Annual Savings (kWh)	
		CEE Tier 1	CEE Tier 2
Solid-door refrigerators			
24 (1-door)	2,102	563	1,179
48 (2-door)	3,197	826	1,774
72 (3-door)	4,292	1,088	2,370
Solid-door freezers			
24 (1-door)	4,319	511	1,654
48 (2-door)	7,805	669	2,810
72 (3-door)	11,292	827	3,966
Glass-door refrigerators			
24 (1-door)	3,248	1,091	1,705
48 (2-door)	4,754	1,599	2,496
72 (3-door)	6,261	2,107	3,287

5.2.2 Commercial Ice Makers

Commercial ice-makers represent approximately 11 percent of all commercial refrigeration energy use. Based upon the U.S. Census data from 2002, there were 294,535 commercial ice-makers sold in 2001. Various machines can produce different kinds of ice such as cubes, nuggets or flakes for hotels, restaurants, hospitals and other commercial buildings. Ice cube-making machines, also known as cubers, were initially addressed by CEE due to the fact that they represent roughly 75% of the machines in the market. In addition, these machines have an Air Conditioning and Refrigeration (ARI) test method as well as performance data available through the ARI Automatic Commercial Ice-Cube Machine (ACIM) database.

A typical commercial ice cube making machine, which usually lasts about 7-10 years, consists of a case, insulation, refrigeration system and a water supply system. The types of ice cube machines available are ice-making head units, self contained and remote condensing. The condenser in the refrigeration system of these machines can be either water-cooled or air-cooled. While an air-cooled unit only uses potable water (15-45 gallons per100lbs of ice) for ice-making, water-cooled units use a large amount of condenser water (120-300 gallons per 100lbs of ice) in addition to potable water.

In December 2002, the CEE Board of Directors approved the CEE Commercial Ice-Makers specification for cube making machines. This specification had initially identified two tiers for efficiency which addressed energy consumption and condenser water use (if water-cooled machine). Based upon re-evaluation of this specification by the Commercial Kitchens Committee, a revised specification (see Table 15 and Table 16) was developed with changes in three key areas:

1. Tier 1 slightly modified to reflect the recently adopted EPAct 2005 standards for 2010.

2. Tiers 2 and 3 now have potable water use limits set for both Air-Cooled and Water-Cooled products.
3. Restriction of overall specification to water-cooled machines installed on a closed loop or remote evaporative condenser system.

Table 15 - CEE Air Cooled Ice-cube Machine Specification

Equipment Type	Harvest Rate (lbs ice/day)	Tier	Corresponding Base Specification	Energy Use Limit (kWh/100lbs Ice)	Potable Water Use Limit (gal./100lbs Ice)
Ice-Making Head	<450	1	Approximately FEMP	10.26 – 0.0086H	--------
		2	10% below Tier 1	9.23 - 0.0077H	≤25
		3	15% below Tier 1	8.72 - 0.0073H	≤20
	≥450	1	Approximately FEMP	6.89 - 0.0011H	--------
		2	10% below Tier 1	6.20 - 0.0010H	≤25
		3	15% below Tier 1	5.86 - 0.0009H	≤20
Remote-Condensing w/out remote compressor	<1000	1	Approximately FEMP	8.85 - 0038H	--------
		2	9% below Tier 1	8.05 - 0.0035H	≤25
		3	15% below Tier 1	7.52 - 0.0032H	≤20
	≥1000	1	Approximately FEMP	5.10	--------
		2	9% below Tier 1	4.64	≤25
		3	15% below Tier 1	4.51	≤20
Remote-Condensing with remote compressor	<934	1	Approximately FEMP	8.85 - 0.0038H	--------
		2	9% below Tier 1	8.05 - 0.0035H	≤25
		3	15% below Tier 1	7.52 - 0.0032H	≤20
	≥934	1	Approximately FEMP	5.30	--------
		2	9% below Tier 1	4.64	≤25
		3	15% below Tier 1	4.51	≤20
Self-Contained	<175	1	Approximately FEMP	18.0 - 0.0469H	--------
		2	7% below Tier 1	16.7 - 0.0436H	≤35
		3	15% below Tier 1	15.3 - 0.0399H	≤30
	≥175	1	Approximately FEMP	9.80	--------
		2	7% below Tier 1	9.11	≤35
		3	15% below Tier 1	8.33	≤30

Table 16 - CEE Water Cooled Ice-cube Machine specification.

Equipment Type	Harvest Rate (lbs ice/day)	Tier	Corresponding Base Specification	Energy Use Limit (kWh/100lbs Ice)	Potable Water Use Limit (gal/100lbs Ice)	Condenser Use Limit* (gal/100lbs Ice)
Ice-Making Head	<500	1	Approximately FEMP	7.80 – 0.0055H	--------	200 - 0.022H
		2	10% below Tier 1	7.02 – 0.0049H	≤25	See Footnote[1]

		3	15% below Tier 1	6.63 – 0.0047H	≤20	See Footnote[1]
	≥500	1	Approximately FEMP	5.58 – 0.0011H	--------	200 - 0.022H
		2	8% below Tier 1	5.13 – 0.0010H	≤25	See Footnote[1]
		3	15% below Tier 1	4.74 – 0.0009H	≤20	See Footnote[1]
	≥1436	1	Approximately FEMP	4.0	--------	200 - 0.022H
		2	8% below Tier 1	3.7	≤25	See Footnote[1]
		3	15% below Tier 1	3.4	≤20	See Footnote[1]
Self-Contained	<200	1	Approximately FEMP	11.4 – 0.0190H	--------	191 – 0.0315H
		2	7% below Tier 1	10.6 – 0.0177H	≤35	See Footnote[1]
		3	15% below Tier 1	9.69 – 0.0162H	≤30	See Footnote[1]
	≥200	1	Approximately FEMP	7.6	--------	191 – 0.0315H
		2	7% below Tier 1	7.07	≤35	See Footnote[1]
		3	15% below Tier 1	6.66	≤30	See Footnote[1]

[*] Condenser use is no longer limited since this specification only promotes water-cooled machines installed on a closed loop or remote evaporative condenser system.

5.2.2.1 Market Availability

There are five major manufacturers of ice machines; Manitowoc with a relative market share of 30%, Scotsman/Crystal Tips (25%), Hoshizaki (20%), and Ice-O-Matic/Mile High (15%) and Cornelius (less than 10% market share). Based upon the number of products available, as of June 2008, 73% meet CEE Tier 1 levels and 28% meet Tier 2 levels and 9% meet Tier 3 levels.

The incremental cost between a standard model and a more efficient model varies with the model and capacity. In many cases, it is negligible. For example, the cost for a less efficient water-cooled ice-making head unit with a harvest rate of 500 lbs/day is around $2,600; a more efficient model can be purchased for about $1,940. On the other hand, a less efficient air-cooled ice-making head unit with a harvest rate of 1,000 lbs/day costs around $3,000 and a more efficient model goes for about $3,285. The incremental cost is $285, yielding a payback of 1.1 years. First-cost estimates assume a 50 percent discount from list price; payback calculations assume 3,000 operating hours/year and an electricity rate of 7 cents/kWh.

5.2.2.2 Water and Energy Savings Opportunities

Water and energy savings vary based upon the type of ice machine; Ice Making Head, Self Contained and Remote Condensing. In addition, the capacity of the machine will impact the potential energy savings. Typically, as the capacity size increases the less energy is consumed by the machine. Table 17 provides a listing of the energy savings potential based upon the equipment type and size.

Table 17 - Energy Savings for Ice Cube Machines at CEE Tiers.

	Harvest (lb/24-hr)	Maximum Annual Energy Consumption (kWh/yr)[1]				Annual kWh Savings (kWh/yr)[2]			Annual kWh Savings (%)		
		Base Case	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3	Tier 1	Tier 2	Tier 3
Ice-Making Heads	**Air-Cooled**										
	200	2689	2494	2244	2120	270	512	633	10	19	24
	500	4716	4628	4165	3934	226	675	900	5	14	19
	1000	8629	8453	7608	7185	429	1249	1659	5	14	19
	Water-Cooled										
	200	2140	1956	1800	1663	243	394	527	11	18	25
	500	3862	3672	3378	3121	300	585	834	8	15	22
	1000	6950	6541	6018	5560	605	1113	1557	9	16	22
	1500	10381	8760	8059	7446	1883	2563	3158	18	25	30
Self Contained	**Air-Cooled**										
	100	2037	1943	1807	1652	152	284	434	7	14	21
	150	2246	2401	2233	2041	0	80	266	0	4	12
	200	2894	2862	2661	2432	118	312	534	4	11	18
	Water-Cooled										
	100	1607	1387	1290	1179	262	356	464	16	22	29
	175	1951	2063	1919	1754	0	90	250	0	5	13
	250	2668	2774	2580	2358	0	166	381	0	6	14
Remote Condensing Unit	**Air-Cooled**										
	400	4205	4281	3895	3639	53	426	675	1	10	16
	800	6961	6786	6175	5768	379	971	1366	5	14	20
	1200	9636	8935	8131	7595	969	1749	2269	10	18	24

1 Assuming that the unit operates at 40% of Capacity (based on ADL 1996 Study)
2 Assuming that higher efficient models are performing 3% better than specifications.

The water savings potential by using the CEE specification can be substantial especially since water cooled units are only recommended for installation on a closed loop system as opposed to an open loop system where fresh water is continuously used. Table 18 provides an analysis of the water and energy savings potential with a qualifying CEE Tier 1 and Tier 2 unit as compared to a Base Case unit.

Table 18 – Water and energy savings potential with efficient Air-Cooled Remote Condensing Unit Ice Machines*.

	Base Case	CEE Tier 1	CEE Tier 2	Tier 2 Savings
Ice Harvest Rate (lbs of ice/day)	561	570	570	n/a
Energy Consumption Rate (kWh/day)	7.1	6.5	5.9	n/a
Potable Water Use (gallons/100# of ice)	37.1	26.4	20	17.1
Daily Energy Use (kWh)	39.76	37.5	30.4	9.36

Daily Water Use (gallons)	208	150	114	94
Annual Electricity Cost ($)	$1478.25	$1368.75	$1226.40	$251.85
Annual Water Cost ($)	$514.65	$365.00	$277.40	$237.25
Overall Annual Cost ($)	$1992.90	$1733.35	$1503.80	$489.10

Assumes operation at 365 days per year, 70 degree water temperature rise, electric costs of $0.10 per kwh, water costs of $2.00 per ccf and sewer costs of $3.00 per ccf.

5.3 Sanitation

Sanitation refers to equipment that serves a function related to waste disposal or cleaning. In the foodservice sector, this type of equipment uses roughly 300 billion gallons of water per year. The main types of sanitation equipment found in commercial kitchens are dishwashers, faucets and garbage disposal/grinders. Roughly 10-20% of the energy or water use in commercial kitchens is related to sanitation.

Table 19 - Sanitation technologies relevant to restaurants.

		~Annual Consumption			~Savings Potential (%)		
Equipment	**Life (yrs)**	**W (10^3 Gal.)**	**G (Mbtu)**	**E (MWh)**	**W**	**G**	**E**
Dishwashers	**20-25**	**350-1100**	**170-200**	**50-70**	**30-50%**	**30-50%**	**30-50%**
Pre-Rinse Spray Valves	**5-7**	**270-400**	**180-230**	**40-60**	**30-60%**	**30-60%**	**30-60%**

5.3.1 Pre-Rinse Spray Valves

A pre-rinse spray valve is a handheld device that uses a spray of water to remove food waste from dishes prior to cleaning in a commercial dishwasher. They are usually placed at the entrance to a commercial dishwasher and can also be located over a sink, in conjunction with a faucet fixture. A national standard requires all pre-rinse spray valves manufactured after January 1, 2006, to have a maximum flowrate of 1.6 gallons per minute (gpm). Prior to this Act being adopted there was an opportunity to nationally define efficiency for this technology using flowrate and cleanability.

After determining that the new federal minimum significantly reduced the savings potential of the technology (i.e., savings from the best performing relative to a model meeting the new standard), the committee developed a guide that focuses on educating program administrators about how to ensure performance of low-flow units by including a cleanability requirement in any promotion activities. This guide includes the following sections:

- ✓ Product Description
- ✓ Product Performance and Assumptions
- ✓ Program Implications
- ✓ Product Availability

5.3.1.1 Market Availability

There are three major manufacturers of pre-rinse spray valves: Fisher Manufacturing, Chicago Faucets, and T&S Brass and Bronze Works, Inc. Each of these manufacturers offers a low-flow product that does not sacrifice cleaning performance. According to Foodservice Equipment Reports' *2004 Worldwide Buyers Guide*, there are approximately 18 additional companies that also manufacture pre-rinse spray units. A listing of efficient products can be found through PG&E's Food Service Technology Center - www.fishnick.com/saveenergy/sprayvalves/. Products meeting the California statewide standard will be listed on the California Energy Commission's website in January, 2006 - www.energy.ca.gov/appliances/.

5.3.1.2 Energy and Water Savings Opportunity

Customers benefit from increased water efficiency through reduced water and sewer bills as well as lower energy bills. Under normal operating conditions, low-flow, pre-spray valves can reduce flowrates by 46 percent, from an average of 3gpm to 1.6gpm for existing spray valves. Increased water efficiency yields a direct savings in energy by reducing the amount of water that needs to be heated.

Estimates of the energy requirements for water heating vary based on the type and efficiency of the water heater, usage patterns, and other variables. To estimate potential energy and water savings, see the PRSV calculator tool on the PG&E Food Service Technology Center website: http://www.fishnick.com/tools/watercost. Examples are provided below for spray valves using electric and natural gas water heating.

Table 20 – Savings potential with water and energy efficient PRSVs using natural gas water heating.

	New Spray Valve	Old Spray Valve	Savings*
Flow Rate (gpm)	1.6	3.5	1.9
Annual Water Consumption (Gallons)	140,160	306,600	166,440
Annual Water Heating Energy (therms)	1,168	2,554	1,386
Annual Water and Sewer Cost ($)	937	2,049.50	1,112.50
Annual Water Heating Cost ($)	1,167.53	2,553.98	1,386.45
Overall Annual Cost ($)	2,104.53	4,603.48	2,498.95

Table 21 - Savings potential with water and energy efficient PRSVs using electric water heating.

	New Spray Valve	Old Spray Valve	Savings*
Flow Rate (gpm)	1.6	3.5	1.9
Annual Water Consumption (Gallons)	140,160	306,600	166,440
Annual Water Heating Energy (kWh)	25,206	55,139	29,933
Annual Water and Sewer Cost ($)	937	2,049.50	1,112.50
Annual Water Heating Cost ($)	2,520.62	5,513.85	2,993.23
Overall Annual Cost ($)	3,457.62	7,563.35	4,105.73

**Assumes spray valve operation 4 hours per day, 365 days per year, 95 percent efficient electric water heater, 70 degree water temperature rise, electric costs of $0.10 per kwh, water costs of $2.00 per ccf and sewer costs of $3.00 per ccf.*

5.3.2 Commercial Dishwashers

Commercial dishwashers are available in a variety of types, sizes, and with different flow rates. The four main types of commercial dishwashing machines are: under counter; door type; conveyor; and flight. Commercial dishwashers are compared in the marketplace through an array of different criteria. The most significant criteria include:

- Operating capacity – measured in dishes per hour and racks per hour;
- Cycle time – measured in seconds;
- Quality – cleanliness of dishes;
- Water consumption – measured in gallons per hour and gallons per rack.

In October 2007, ENERGY STAR launched a specification for commercial dishwashers for under counter, door type, and conveyor units based on water consumption and idle energy rate. The specification defines commercial dishwashers as “a machine designed to clean and sanitize plates, glasses, cups, bowls, utensils, and trays by applying sprays of detergent solution (with or without blasting media granules) and a sanitizing final rinse.” The CEE Commercial Kitchens Committee agreed to create a specification consistent with ENERGY STAR water consumption and idle energy rate criteria (see Table 22).

Table 22 – CEE Specification Criteria for Commercial Dishwashers

Equipment	Corresponding Base Specification	High Temperature Efficiency Requirements***		Low Temperature Efficiency Requirements***	
		Idle Energy Rate*	Water Consumption	Idle Energy Rate*	Water Consumption
Under Counter	ENERGY STAR	<= 0.90 kW	<= 1.00 gal/rack	<= 0.5 KW	<= 1.70 gal/rack
Stationary Single Tank Door**	ENERGY STAR	<= 1.0 kW	<= 0.950 gal/rack	<= 0.6 kW	<= 1.18 gal/rack
Single Tank Conveyor	ENERGY STAR	<= 2.0 kW	<= 0.700 gal/rack	<= 1.6 kW	<= 0.790 gal/rack
Multiple Tank Conveyor	ENERGY STAR	<= 2.6 kW	<= 0.540 gal/rack	<= 2.0 kW	<= 0.540 gal/rack

* Idle energy rate as measured with door closed and rounded to 2 significant digits.
** Includes pot, pan, and utensil machines.
*** Machines designed to be interchangeable in the field from high temp to low temp, and vice versa, must meet both the high temp and low temp requirements to qualify.

5.3.2.1 Market Availability

According to the Foodservice Equipment Reports 2004 Worldwide Buyers Guide, there are 24 manufacturers of rack/cabinet/tray commercial dishwashers and 23 manufacturers of under counter dishwashers (most manufacture both). Major manufacturers in the United States include: American Dish Service; Auto-Chlor System; Champion Industries (part of the Ali Group); CMA Dishmachines; Electrolux Professional; Fagor Commercial; Hobart Corporation; Insinger Machine Company; Jackson MSC, LLC; Meiko USA; Moyer Diebel Ltd. (part of the Ali Group); and Stero, a division of Illinois Tool Works, Inc. As of June 2008, 163 products across 14 manufacturers qualify under the requirements in Table 22. See Table 23 below for a summary of the number of qualifying products by dishwasher type as of June 2008.

The incremental cost between a standard commercial dishwasher and its energy efficient counterpart ranges from $1,000 - $4,000 depending on dishwasher type. Table 23 also includes a summary of incremental costs by dishwasher type.

Table 23 – Number of Qualified Products Offered and Incremental Cost by Machine Type

Dishwasher Type	Number of Qualified Products Offered	Estimated Standard Equipment Cost	Estimated High Efficiency Equipment Cost	Estimated Incremental Cost
High Temperature, Multiple Tank Conveyor	23	$20,000	$24,000	$4,000
High Temperature, Single Tank Conveyor	47	$12,000	$15,000	$3,000
High Temperature, Door Type	18	$6,900	$9,000	$2,100
High Temperature, Under Counter	16	$5,000	$6,000	$1,000
Low Temperature, Multiple Tank Conveyor	0	$18,000	$22,000	$4,000
Low Temperature, Single Tank Conveyor	3	$11,000	$14,000	$3,000
Low Temperature, Door Type	3	$6,500	$8,500	$2,000
Low Temperature, Under Counter	12	$4,800	$5,800	$1,000
High/Low Temperature, Multiple Tank Conveyor	12	See above	See above	See above
High/Low Temperature, Single Tank Conveyor	25	See above	See above	See above
High Low Temperature, Door Type	4	See above	See above	See above

5.3.2.2 Energy and Water Savings Potential

Energy savings from more efficient commercial dishwashers can occur in four primary ways: building water heater energy consumption; booster heater energy consumption (for high temp machines), idle energy consumption, and wash energy consumption. When a dishwasher uses less water, energy is saved by heating less water at the building and booster heater levels. Idle energy refers to the energy consumed by machines to maintain water temperatures within the machine when the unit is not operating. Wash energy consumption is the energy used during the wash cycle. Due to incomplete test methods, wash energy consumption is not part of this specification. Table 24 through Table 27 provide a summary of energy and water savings by dishwasher type and building and booster heater fuel type based on ENERGY STAR's Commercial Dishwasher calculator at www.energystar.gov.

Table 24 – Water and energy savings by dishwasher type with electric building hot water heater and electric booster heater.

	Typical Product Life	Typical Racks / Day	ENERGY STAR			Conventional			Savings/Unit		
			gallons/yr	kwh/yr	therms/yr	gallons/yr	kwh/yr	therms/yr	gallons/yr	kwh/yr	therms/yr
Under Counter, Low Temp	10	75	45,900	8,965	0	52,650	10,161	0	6750	1196	0
Under Counter, High Temp	10	75	27,000	9,844	0	53,460	17,212	0	26460	7369	0
Door Type, Low Temp	15	280	118,944	21,534	0	186,480	33,502	0	67536	11969	0
Door Type, High Temp	15	280	95,760	28,867	0	145,152	42,817	0	49392	13950	0
Single Tank Conveyor, Low Temp	20	400	113,760	24,135	0	177,120	35,363	0	63360	11228	0
Single Tank Conveyor, High Temp	20	400	100,800	39,591	0	162,720	58,563	0	61920	18972	0
Multi Tank Conveyor, Low Temp	20	600	116,640	29,311	0	213,840	46,536	0	97200	17225	0
Multi Tank Conveyor, High Temp	20	600	116,640	46,306	0	237,600	79,992	0	120960	33685	0

Table 25 - Water and energy savings by dishwasher type with electric building hot water heater and gas booster heater.

	Typical Product Life	Typical Racks / Day	ENERGY STAR			Conventional			Savings/Unit		
			gallons/yr	kwh/yr	therms/yr	gallons/yr	kwh/yr	therms/yr	gallons/yr	kwh/yr	therms/yr
Under Counter, Low Temp	10	75	45,900	8,965	0	52,650	10,161	0	6750	1196	0
Under Counter, High Temp	10	75	27,000	7,110	111	53,460	11,799	219	26460	4689	109
Door Type, Low Temp	15	280	118,944	21,534	0	186,480	33,502	0	67536	11969	0
Door Type, High Temp	15	280	95,760	19,170	393	145,152	28,118	596	49392	8948	203
Single Tank Conveyor, Low Temp	20	400	113,760	24,135	0	177,120	35,363	0	63360	11228	0
Single Tank Conveyor, High Temp	20	400	100,800	29,383	414	162,720	42,085	668	61920	12701	254
Multi Tank Conveyor, Low Temp	20	600	116,640	29,311	0	213,840	46,536	0	97200	17225	0
Multi Tank Conveyor, High Temp	20	600	116,640	34,495	479	237,600	55,931	975	120960	21436	496

Table 26 - Water and energy savings by dishwasher type with gas building hot water heater and electric booster heater.

	Typical Product Life	Typical Racks / Day	ENERGY STAR			Conventional			Savings/Unit		
			gallons/yr	kwh/yr	therms/yr	gallons/yr	kwh/yr	therms/yr	gallons/yr	kwh/yr	therms/yr
Under Counter, Low Temp	10	75	45,900	830	377	52,650	830	432	6750	0	55
Under Counter, High Temp	10	75	27,000	5,059	222	53,460	7,738	439	26460	2680	217
Door Type, Low Temp	15	280	118,944	455	976	186,480	455	1,531	67536	0	554
Door Type, High Temp	15	280	95,760	11,897	786	145,152	17,093	1,191	49392	5197	405
Single Tank Conveyor, Low Temp	20	400	113,760	3,974	934	177,120	3,974	1,454	63360	0	520
Single Tank Conveyor, High Temp	20	400	100,800	21,728	827	162,720	29,726	1,336	61920	7998	508
Multi Tank Conveyor, Low Temp	20	600	116,640	8,640	957	213,840	8,640	1,755	97200	0	798
Multi Tank Conveyor, High Temp	20	600	116,640	25,636	957	237,600	37,885	1,950	120960	12249	993

Table 27 - Water and energy savings by dishwasher type with gas building hot water heater and gas booster heater.

	Typical Product Life	Typical Racks / Day	ENERGY STAR			Conventional			Savings/Unit		
			gallons/yr	kwh/yr	therms/yr	gallons/yr	kwh/yr	therms/yr	gallons/yr	kwh/yr	therms/yr
Under Counter, Low Temp	10	75	45,900	830	377	52,650	830	432	6750	0	55
Under Counter, High Temp	10	75	27,000	2,325	332	53,460	2,325	658	26460	0	326
Door Type, Low Temp	15	280	118,944	455	976	186,480	455	1,531	67536	0	554
Door Type, High Temp	15	280	95,760	2,199	1,179	145,152	2,394	1,787	49392	195	608
Single Tank Conveyor, Low Temp	20	400	113,760	3,974	934	177,120	3,974	1,454	63360	0	520
Single Tank Conveyor, High Temp	20	400	100,800	11,520	1,241	162,720	13,248	2,004	61920	1728	762
Multi Tank Conveyor, Low Temp	20	600	116,640	8,640	957	213,840	8,640	1,755	97200	0	798
Multi Tank Conveyor, High Temp	20	600	116,640	13,824	1,436	237,600	13,824	2,926	120960	0	1489

6 Participation

As with all Initiatives of CEE, participation in the Commercial Kitchens Initiative is voluntary. Since the Initiative addresses water and energy-efficiency opportunities and water efficiency program representatives actively participated on the committee, it is expected that water agencies will participate – either in partnership with local energy-efficiency programs or individually. To be considered an Initiative participant, one must support the CEE Commercial Kitchens Initiative through the following activities:

1. Incorporate at least one of the Initiative specifications/guidelines in an educational or incentive based regional/local program.

2. Communicate the scope, duration, and key aspects of their respective regional/local programs to CEE staff when requested.

3. Allow the use of their organization's name and program information for the purpose of achieving the initiative's goals.

7 Initiative Approach

The approach defined by this Initiative consists of identifying and encouraging the purchase of energy efficient products that are relevant to key foodservice market segments and distribution channels. Given the size and complexity of the food service market, promoting energy-efficiency in commercial kitchens has been a challenge for program effectiveness. This Initiative incorporates two principal strategies to enhance program effectiveness.

First, the Initiative adopts a matrix approach in recommending commercial kitchen technologies and market segments for programs to address. From a technology perspective, the Commercial Kitchen Committee considered potential energy and water savings from a list of common commercial kitchen equipment, taking into consideration the level and type of savings available (gas, water, electricity). The Initiative also takes into consideration which combinations of technologies would result in the greatest water and energy savings when offered to a particular market segment, such as restaurants, schools or hospitals. In this way, the Committee engaged in an ongoing process of evaluating commercial kitchen technologies – individually, as a group and when applied to a particular market segment. As program experience and support builds over time, initiative resources and insights can be easily transferred to serve additional target market segments, such as hospitals or schools.

Second, cooperation between local energy and water programs has the potential to bring additional resources and support for commercial kitchen efficiency. It also brings a consistent and relevant message on what constitutes commercial kitchen efficiency to the market at the local and national level and avoids potential confusion.

8 CEE Role

CEE will support the ongoing Initiative efforts, develop and manage a compliant products list where applicable, promote and encourage specification adoption within voluntary programs, correspond with industry and investigate the merits of additional specifications. The following list identifies additional efforts of CEE in this initiative:

- Secure support for the Initiative by utilities, retailers, manufacturers and others
- Facilitate development of common specifications
- Provide program updates to manufacturers and retailers on initiative participation
- Facilitate information exchange for initiative participants – best practices for consumers and retailers
- Promotion of initiative
- Maintain and distribute qualifying products lists