CHAPTER 6. MARKUPS FOR EQUIPMENT PRICE DETERMINATION

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CHAPTER 6. MARKUPS FOR EQUIPMENT PRICE DETERMINATION

6.1 INTRODUCTION

To carry out the life-cycle cost (LCC) calculations described in chapter 8, the U.S. Department of Energy (DOE) needed to determine the cost to the customer of baseline walk-in coolers and freezer units (WICFs). This cost was determined for both baseline equipment and more-efficient equipment the customer would purchase following the promulgation of new standards. However, the customer price of such equipment is not known because it depends on how the equipment is purchased. What is known is the manufacturer's selling price (MSP) for both baseline equipment and the more-efficient equipment as determined in the Engineering Analysis (chapter 5). By applying a multiplier called a "markup" to the MSP, DOE was able to estimate the customer price of equipment purchased through various distribution channels for different market segments. This chapter describes how DOE derived the markups.

The cost to the customer depends on how the customer purchases the equipment. In the framework document, DOE defined three distribution channels described below:

Manufacturer → Customer (National Account) (Channel 1)
Manufacturer → Distributor → Customer (Channel 2)
Manufacturer → Distributor → Mechanical Contractor → Customer (Channel 3)

In the first distribution channel, it was envisaged that the manufacturer sells the equipment directly to the customer through a national account, often a large grocery or supermarket chain. In the second and third distribution channels, it was presumed that the manufacturer sells the equipment to a distributor, who in turn may sell it directly to the customer or through a mechanical contractor. The distributor, in this case, may be a dealer focusing on refrigeration equipment or foodservice equipment or a grocery warehouser (supply-chain distributor) who sells food and stores equipment to the grocery store. In some cases, the manufacturer may distribute the walk-ins directly to mechanical contractors, in effect functioning as a distributor. Based on the feedback received from the stakeholders during the public meeting and DOE's own study of the distribution chain, DOE realized that for the WICF systems, the distribution channels for the two broad market segments, viz., the grocery segment and the food service segments, are somewhat different. The distribution channels for refrigeration equipment are shown for the grocery segment in Figure 6.1.1 and for the foodservice segment in Figure 6.1.2. The corresponding walk-in cooler and freezer "envelopes" are assumed to follow the same distribution channels; i.e., if an envelope is sold with a unit cooler only (remote condenser), then it follows the same distribution channel as the multiplex refrigeration equipment. If the envelope is sold with a dedicated refrigeration system, then it follows the same distribution channels as the dedicated refrigeration equipment.

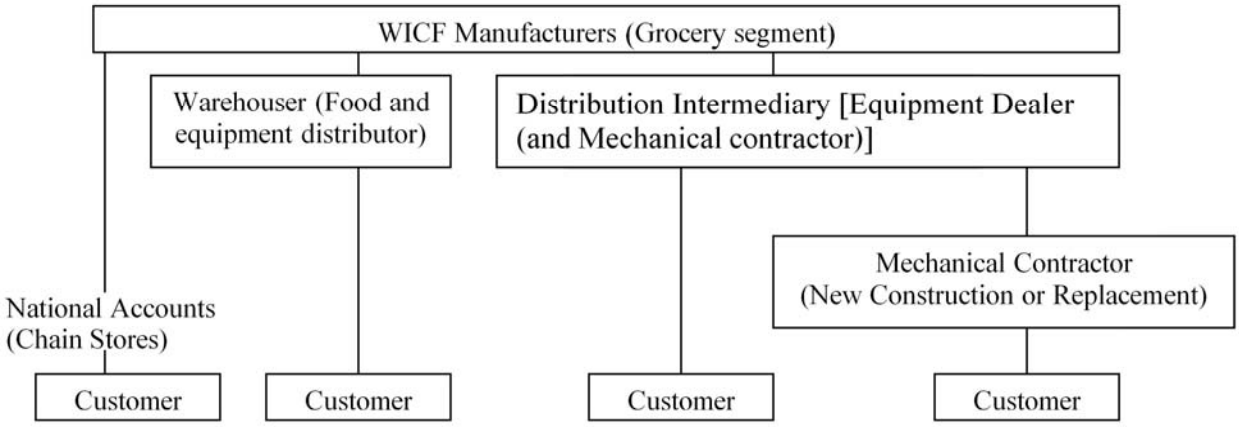

Figure 6.1.1 Distribution Channels and Shares for WICF used in Grocery/Supermarkets

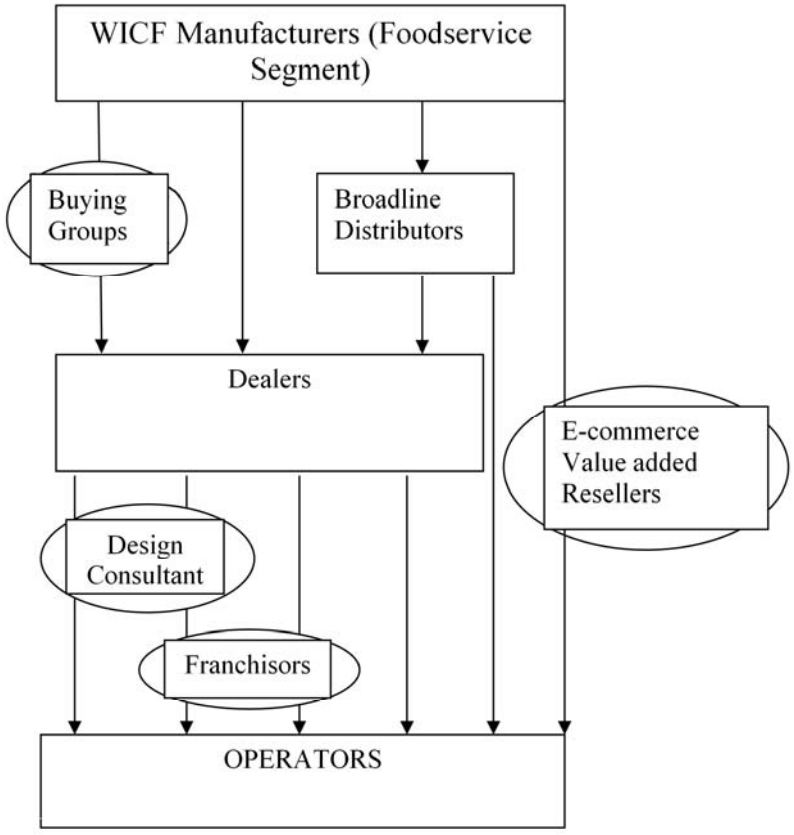

Figure 6.1.2 Distribution Channels and Shares for WICF Used in Foodservice

It is seen from Figure 6.1.1 and Figure 6.1.2 that the distribution networks for the two different product segments follow somewhat different paths though there is overlap at times. One instance of possible overlap is when a distribution intermediary for the refrigeration equipment also has an interest in selling smaller walk-in systems for the foodservice segment. A further key feature of the distribution network in food-service equipment is the presence of buying groups, which are dealer associations formed with the intent of consolidating purchases. Ten active

buying groups are listed by the Foodservice Equipment Dealers Association (FEDA).[1] For the smaller walk-in systems used in the foodservice segment, there are several E-commerce resellers who offer a choice of new and used equipment. FEDA in their policy statement denounces such activity.[2]

Table 6.1.1 gives the estimated distribution channel shares (in percentage of total sales) through each of the main distribution channels for multiplex and dedicated equipment. It is assumed that the channel shares for the walk-in systems used in the grocery and convenience store segments would shadow similar figures for the commercial refrigeration equipment that serves identical market segments. Consequently, the channel shares for the grocery market segment in Table 6.1.1 are based on DOE's estimates for the commercial refrigeration equipment.[3] The channel market shares for the WICF used in the foodservice segments are estimates.

Table 6.1.1 Distribution Channel Shares

Dominant Market Segment	Multiplex Equipment		
All	National Account	Distributor	Contractor
	70%	15%	15%
Dedicated Equipment			
Convenience Stores and Groceries (50%)	National Account	Distributor	Contractor
	30%	35%	35%
Food Service (50%)	E-Commerce Reseller	Distributor	Contractor
	10%	80%	10%

The following equation describes how DOE determined the equipment price if a customer purchases directly from the manufacturer through a national account:

$$EQP_{CUST} = MFG_{BASE} \times MU_{NATL\ ACCT} \times (1 + ST) \qquad \textbf{Eq. 6.1}$$

where:

EQP_{CUST} = equipment price to the customer ($),
MFG_{BASE} = manufacturer selling price of baseline equipment ($),
$MU_{NATL\ ACCT}$ = national account markup, and
ST = sales tax rate.

The following equation describes how DOE determined the equipment price if a distributor sells the equipment to the customer through the distributor distribution channel:

$$EQP_{CUST} = MFG_{BASE} \times MU_{DISTR} \times (1 + ST) \qquad \textbf{Eq. 6.2}$$

where:

MU_{DISTR} = Distributor markup.

The following equation describes how DOE determined the equipment price if a mechanical contractor sells the equipment to the customer through the distributor distribution channel:

$$EQP_{CUST} = MFG_{BASE} \times MU_{DISTR} \times MU_{MECH\ CONT} \times (1 + ST) \quad \textbf{Eq. 6.3}$$

where:

$MU_{MECH\ CONT}$ = residential and light commercial mechanical contractor markup.

The markup multiplier to the equipment price is thus lessened for shorter distribution channels.

For each of the markups presented above, DOE further differentiated between a baseline markup and an incremental markup, as described below. The overall markup is then the product of all the markups plus sales tax within a distribution channel.

6.1.1 Baseline Markups

DOE defined baseline markups as cost multipliers that relate the purchase cost to selling price for each step of the distribution channel.

If sold to a customer by the manufacturer through a national account, the following equation defines the equipment price:

$$EQP_{NATL\ ACCNT\ BASE} = MFG_{BASE} \times MU_{NATL\ ACCT\ BASE} \times (1+ST) \quad \textbf{Eq. 6.4}$$

where:

$EQP_{NATL\ ACCNT\ BASE}$ = national account price to the customer of baseline equipment ($), and
$MU_{NATL\ ACCT\ BASE}$ = national account markup on baseline equipment.

If sold to a customer by a distributor:

$$EQP_{DISTR\ BASE} = MFG_{BASE} \times MU_{DISTR\ BASE} \times (1+ST) \quad \textbf{Eq. 6.5}$$

If sold to a customer by a mechanical contractor:

$$EQP_{MECH\ CONT\ BASE} = EQP_{DISTR\ BASE} \times MU_{MECH\ CONT\ BASE} \quad \textbf{Eq. 6.6}$$

where:

$EQP_{DISTR\ BASE}$ = distributor price of baseline equipment ($),
$EQP_{MECH\ CONT\ BASE}$ = mechanical contractor price of baseline equipment ($), and
$MU_{MECH\ CONT\ BASE}$ = mechanical contractor markup on baseline equipment.

The use of the markups results in the distributor ($EQP_{DISTR\ BASE}$) and mechanical contractor ($EQP_{MECH\ CONT\ BASE}$) prices of the baseline WICF equipment.

6.1.2 Incremental Markups

Incremental markups are cost multipliers that relate incremental changes in the manufacturer selling price of higher efficiency equipment that result, in this case, from efficiency

improvements, to changes in the distributor or contractor sales price, as shown in the following equations:

If sold to a customer by the manufacturer through a national account, the following equation defines the increase in equipment price above that of baseline equipment:

$$EQP_{NATL\ ACCNT\ INCR} = MFG_{INCR} \times MU_{NATL\ ACCT\ INCR} \times (1+ST) \quad \textbf{Eq. 6.7}$$

where:

$EQP_{NATL\ ACCNT\ INCR}$ = incremental equipment price to the national account customer ($),
MFG_{INCR} = change in the manufacturer selling price of higher efficiency equipment brought about by an increase in efficiency due to new standards ($), and
$MU_{NATL\ ACCT\ INCR}$ = national account incremental markup.

If sold by a distributor directly to a customer or by a mechanical contractor after passing through a distributor:

$$EQP_{DISTR\ INCR} = MFG_{INCR} \times MU_{DISTR\ INCR} \times (1+ST) \quad \textbf{Eq. 6.8}$$

$$EQP_{MECH\ CONT\ INCR} = EQP_{DISTR\ INCR} \times MU_{MECH\ CONT\ INCR} \quad \textbf{Eq. 6.9}$$

where:

$EQP_{DISTR\ INCR}$ = incremental distributor price ($),
$EQP_{MECH\ CONT\ INCR}$ = incremental mechanical contractor price ($),
$MU_{DISTR\ INCR}$ = incremental distributor markup, and
$MU_{MECH\ CONT\ INCR}$ = incremental mechanical contractor markup.

In these equations, $MU_{NATL\ ACCTINCR,}$ $MU_{DISTR\ INCR,}$ and $MU_{MECH\ CONT\ INCR}$ refer to the incremental national account, incremental distributor, and incremental mechanical contractor markups, respectively, which are applied to the incremental MSP. The use of the incremental markups results in the incremental distributor ($EQP_{DISTR\ INCR}$) and incremental mechanical contractor ($EQP_{MECH\ CONT\ INCR}$) prices.

6.1.3 Overall Markups

Overall markups, including both overall baseline and overall incremental markups, relate the manufacturer selling price to the customer price as indicated by the following equations:

$$EQP_{CUST\ BASE} = MFG_{BASE} \times (WT_{NATL\ ACCNT\ BASE} \times MU_{NATL\ ACCT\ BASE} + WT_{DISTR\ BASE} \times MU_{DISTR\ BASE} + WT_{MECH\ CONT\ BASE} \times MU_{DISTR\ BASE} \times MU_{MECH\ CONT\ BASE}) \times (1+ST)$$
$$= MFG_{BASE} \times MU_{OVERALL\ BASE} \quad \textbf{Eq. 6.10}$$

$$EQP_{CUST\ INCR} = MFG_{INCR} \times (WT_{NATL\ ACCNT\ INCR} \times MU_{NATL\ ACCT\ INCR} + WT_{DISTR\ INCR} \times MU_{DISTR\ INCR} + WT_{MECH\ CONT\ INCR} \times MU_{DISTR\ INCR} \times MU_{MECH\ CONT\ INCR}) \times (1+ST)$$
$$= MFG_{INCR} \times MU_{OVERALL\ INCR} \quad \textbf{Eq. 6.11}$$

$$EQP_{CUST} = EQP_{CUST\ BASE} + EQP_{CUST\ INCR} \quad \textbf{Eq. 6.12}$$

where:

$MU_{OVERALL\ BASE}$	=	overall weighted baseline markup that is the product of all the weights and baseline markups for each step of the distribution channel,
$MU_{OVERALL\ INCR}$	=	overall weighted incremental markup that is the product of all the weights and incremental markups for each step of the distribution channel,
$EQP_{CUST\ BASE}$	=	baseline customer price ($),
$EQP_{CUST\ INCR}$	=	incremental customer price ($),
EQP_{CUST}	=	total customer price ($),
$WT_{NATL\ ACCNT\ BASE}$	=	weight (percent) of baseline equipment sales through national accounts,
$WT_{DISTR\ BASE}$	=	weight (percent) of baseline equipment sales through distributors,
$WT_{MECH\ CONT\ BASE}$	=	weight (percent) of baseline equipment sales through mechanical contractors,
$WT_{NATL\ ACCNT\ INCR}$	=	weight (percent) of higher efficiency equipment sales through national accounts,
$WT_{DISTR\ INCR}$	=	weight (percent) of higher efficiency equipment sales through distributors, and
$WT_{MECH\ CONT\ INCR}$	=	weight (percent) of higher efficiency equipment sales through mechanical contractors.

Using the overall baseline and overall incremental markups results in the baseline customer price ($EQP_{CUST\ BASE}$) and the incremental customer price ($EQP_{CUST\ INCR}$). For a particular higher efficiency level that increases the manufacturer selling price of equipment, the total price of the equipment to the customer (EQP_{CUST}) is the sum of the baseline customer price ($EQP_{CUST\ BASE}$) and the incremental customer price ($EQP_{CUST\ INCR}$).

6.2 BASIC ASSUMPTIONS USED TO ESTIMATE DISTRIBUTOR AND MECHANICAL CONTRACTOR MARKUPS

DOE derived the distributor and mechanical contractor markups from three key assumptions about WICF costs. DOE based the distributor markups for the refrigeration intermediary on industry balance-sheet data for an industry association and based the mechanical contractor markups on U.S. Census Bureau data for the plumbing, heating, and air conditioning (PHAC) industry.[4] DOE was not able to obtain balance-sheet data for the foodservice equipment distributors even though there is an industry association (FEDA) and several other dealer groups. DOE obtained the industry balance sheet data from the Heating, Air conditioning & Refrigeration Distributors International (HARDI), the trade association representing distributors of refrigeration and heating, ventilating, and air conditioning (HVAC) equipment, specifically the controls and refrigeration specialists within that organization. DOE put the U.S. Census Bureau Plumbing, Heating, and Air-Conditioning Contractors data that was used for developing mechanical contractor markups into the same format as the balance sheet data for distributors. These balance sheets break out the components of all costs incurred by firms that supply and

install PHAC equipment. The three key assumptions used to estimate markups using these financial data are given below.

1. The firm balance sheets accurately represent the various average costs incurred by firms distributing and installing WICF equipment.
2. The distributor and contractor costs can be divided into two categories: (1) costs that vary in proportion to the MSP of WICF equipment (variable costs); and (2) costs that do not vary with the manufacturer selling price of WICF equipment (fixed costs).
3. Distributor and contractor prices vary in proportion to distributor and contractor costs included in the balance sheets.

In support of the first assumption, the balance sheets itemize firm costs into a number of cost categories, including direct costs to purchase or install the equipment, operating labor and occupancy costs, and other operating costs and profit. Although distributors and contractors tend to handle multiple commodity lines (including air conditioners, furnaces, and boilers), the data provide the most accurate available indication of WICF equipment costs.

Previous DOE analysis of the HVAC distributors, contractors, and consultants, including information obtained from the trade literature, support the second assumption.[5,6] This analysis indicates that distributor and contractor markups vary according to the quantity of labor and materials used to distribute and install appliances with markups on labor tending to be much larger than markups on materials. The analysis implies that these distribution-channel markups vary more in relation to sales volume than in relation to other factors, including appliance efficiency. Distribution-channel labor inputs also vary more with sales volume than with appliance cost or efficiency. DOE assumed a division of costs between those that do not scale with the manufacturer selling price (labor and occupancy costs) and those that do (other operating costs and profit). This division of costs led to the estimate of distributor and mechanical contractor markups described below.

In support of the third assumption, the HVAC distributor and contractor industry is competitive, and customer demand for commercial heating and air conditioning is relatively inelastic (*i.e.,* the demand is not expected to decrease significantly with an increase in price of equipment). The large number of distributor firms listed in the 2002 Census indicates the competitive nature of the market. For example, there are almost 1,400 distributors of refrigeration equipment, and 87,000 HVAC contractors.[7] Following standard economic theory, competitive firms facing inelastic demand either set prices in line with costs or quickly go out of business.[8]

6.3 ESTIMATION OF DISTRIBUTOR MARKUPS

Distributors report median data in a confidential survey that HARDI conducted of member firms.[9] In the survey, HARDI itemized revenues and costs into cost categories, including direct equipment expenses (cost of goods sold), labor expenses, occupancy expenses, other operating expenses, and profit. It reported data for various industry segments, including the Controls and Refrigeration industry segment in terms of industry median values. DOE presents these data for Controls and Refrigeration distributors in terms of specific types of expense within these categories in appendix 6A. Table 6.3.1 summarizes these expenses as cost per dollar sales

revenue in the first data column. As shown in this column, the direct equipment expenses (cost of goods sold) represent about $0.688 per dollar sales revenue. In other words, for every $1 distributors take in as sales revenue, they use $0.688 to pay the direct equipment costs. Labor expenses account for $0.195 per dollar sales revenue, occupancy expenses account for $0.036, other operating expenses account for $0.048, and profit accounts for $0.033 per dollar sales revenue.

Table 6.3.1 Distributor Expenses and Markups

Descriptions	Per Dollar Sales Revenue	Per Dollar Cost of Goods
Direct Cost of Equipment Sales: Cost of goods sold	$0.688	$1.000
Labor Expenses: Salaries and benefits	$0.195	$0.283
Occupancy Expense: Rent, maintenance, and utilities	$0.036	$0.052
Other Operating Expenses: Depreciation, advertising, and insurance.	$0.048	$0.070
Profit	$0.033	$0.048
Baseline Revenue: Baseline revenue earned per dollar cost of goods sold		**$1.453**
Wholesaler Baseline Markup ($MU_{WHOLE\ BASE}$)		**1.453**
Incremental Revenue: Increased revenue per dollar increase cost of goods sold		**$1.118**
Incremental Markup ($MU_{WHOLE\ INCR}$)		**1.118**

Source: Heating, Air Conditioning & Refrigeration Distributors International. 2008. 2008 Profit Report (2007 Data).[2]

The last column of Table 6.3.1 shows the data converted from costs per dollar revenue into revenue per dollar cost of goods sold. DOE did this conversion by dividing each cost category in the first data column of Table 6.3.1 by $0.688 (*i.e.*, equipment expenditure per dollar revenue). The data in the last column show that, for every $1.00 the distributor spends on equipment costs, the distributor spends $1.00 in sales revenue to cover the equipment cost, $0.283 to cover labor costs, $0.052 to cover occupancy expenses, $0.070 for other operating expenses, and $0.048 in profits. This totals to $1.453 in sales revenue earned for every $1.00 spent on equipment costs. Therefore, the distributor baseline markup ($MU_{WHOLE\ BASE}$) is approximately 1.453 ($1.453 ÷ $1.00).

DOE also used the data in the last column to estimate the incremental markups. The incremental markup depends on which of the costs in Table 6.3.1 are variable and which are fixed. For example, for a $1.00 increase in the manufacturer equipment price, if all of the other costs scale with the manufacturer selling price (*i.e.*, all costs are variable), the increase in distributor price will be $1.453, implying that the incremental markup is 1.453, or the same as the baseline markup. However, if none of the other costs are variable, then a $1.00 increase in the manufacturer selling price will lead to a $1.00 increase in the distributor price, for an incremental markup of 1.0. DOE assumes that the labor and occupancy costs will be fixed and that the other operating costs and profit will scale with the manufacturer selling price (*i.e.*, be variable). In this case, for a $1.00 increase in the manufacturer selling price, the distributor price will increase by $1.118, giving a distributor incremental markup ($MU_{WHOLE\ INCR}$) of 1.118 ($1.118 ÷ $1.00).

DOE recognizes that there is a possibility of case-to-case deviation in the markups developed from the above financial data. Based on the analysis of U.S. Census Bureau data for distributors, DOE calculated a standard deviation of 4.2 percent. DOE assumed that the variation determined for the baseline markup applied to the incremental markup as well. For the baseline

markup of 1.453, a standard deviation of 4.2 percent translates into an absolute value of 0.061, and for the incremental markup of 1.118, a standard deviation of 4.2 percent translates into an absolute value of 0.047. However, the national data on distribution of WICF units suggests that only about 15 percent of new units sold actually pass through distributors. The case-to-case deviation of distributor markup thus has a very small impact on the overall cost of equipment and can be neglected. DOE applied the same baseline and incremental markup to all sales of WICF units passing through distributors. Further details of these data are shown in appendix 6A.

6.4 ESTIMATION OF MECHANICAL CONTRACTOR MARKUPS

DOE derived markups for mechanical contractors from U.S. Census Bureau data for PHAC contractors (North American Industry Classification System 238220). This sector includes establishments primarily engaged in installing and servicing PHAC equipment, which may include new work, additions, alterations, maintenance, and repairs. The U.S. Census Bureau data for the PHAC sector include detailed statistics for establishments with payrolls, similar to the data reported by HARDI for distributors. The primary difference is that the U.S. Census Bureau reports itemized revenues and expenses for the PHAC industry as a whole in total dollars rather than in typical values for an average or representative business. Because of this, DOE assumed that the total dollar values that the U.S. Census Bureau reported, once converted to a percentage basis, represented revenues and expenses for an average or typical contracting business. As with the data for distributors, Table 6.4.1 summarizes the expenses for mechanical contractors, as expenses per dollar sales revenue, in the first data column (appendix 6A contains the full set of data). The direct cost of sales represents about $0.66 per dollar sales revenue to the mechanical contractor. Labor expenses account for $0.17 per dollar sales revenue, occupancy expenses account for $0.02 per dollar sales revenue, other operating expenses account for $0.03, and profit makes up $0.12 per dollar sales revenue.

DOE converted these expenses per dollar sales into revenue per dollar cost of goods sold by dividing each figure in the first data column by $0.66. The data in the last column show that, for every $1.00 the mechanical contractor spends on equipment costs, the mechanical contractor earns $1.00 in sales revenue to cover the equipment cost, $0.26 to cover labor costs, $0.03 to cover occupancy expenses, $0.05 for other operating expenses, and $0.18 in profits. This totals $1.52 in sales revenue earned for every $1.00 spent on equipment costs. This results in a mechanical contractor baseline markup ($MU_{MECH\ CONT\ BASE}$) of 1.52 ($1.52 ÷ $1.00).

Table 6.4.1 Mechanical Contractor Expenses and Markups*

Description	Mechanical Contractor Firm Expenses or Revenue	
	Per Dollar Sales Revenue	**Per Dollar Cost of Goods Sold**
Direct Cost of Equipment Sales: Cost of goods sold	$0.66	$1.00
Labor Expenses: Salaries (indirect) and benefits	$0.17	$0.26
Occupancy Expense: Rent, maintenance, and utilities	$0.02	$0.03
Other Operating Expenses: Depreciation, advertising, and insurance	$0.03	$0.05
Net Profit Before Taxes	$0.12	$0.18
Baseline Markup ($MU_{WHOLE\ BASE}$): Revenue per dollar cost of goods sold		**1.52**
Incremental Markup ($MU_{WHOLE\ INCR}$): Increased revenue per dollar increase cost of goods sold		**1.23**

* Source: U.S. Census Bureau. 2002. Plumbing, Heating, and Air-Conditioning Contractors: 2002. Report EC02-231-238220, Table 4. Detailed Statistics for Establishments: 2002.

DOE was also able to use the data in the last column in Table 6.4.1 to estimate the incremental markups by being able to separate the fixed and variable costs. For example, if all of the other costs scale with the equipment price (*i.e.,* all costs are variable), the increase in mechanical contractor price will be $1.52, implying that the incremental markup is 1.52, or the same as the baseline markup. However, if none of the other costs are variable, then a $1.00 increase in the equipment price will lead to a $1.00 increase in the mechanical contractor price, for an incremental markup of 1.0. DOE assumes the labor and occupancy costs to be fixed and the other operating costs and profit to scale with the equipment price (*i.e.,* be variable). In this case, for a $1.00 increase in the equipment price, the mechanical contractor price will increase by $1.23, giving a mechanical contractor incremental markup ($MU_{MECH\ CONT\ INCR}$) of 1.23 ($1.23 ÷ $1.00).

6.4.1 Estimation of Mechanical Contractor Markup Probability Distribution

Mechanical contractor costs differ in various regions of the country for reasons including availability of labor, cost of living, union versus non-union workforce, and others. Because many mechanical contractor costs differ systematically by State, DOE characterized the markups developed from U.S. Census Bureau data with a probability distribution based on a State-by-State analysis of U.S. Census Bureau data for PHAC contractors. The State-by-State analysis provided a distribution on the relative markups of mechanical contractors in the United States. DOE then applied the State-level index to the single-point baseline and incremental markups calculated above to create State-level markups. Because the State-by-State distribution of WICF units varies by type of customer (e.g., supermarkets may be more prevalent relative to convenience stores in one part of the country than another), a national-level distribution of the mechanical contractor markup index is different for each class of building.

Figure 6.4.1 shows the cumulative probability distribution of the State markup index that DOE used to characterize the mechanical contractor baseline and incremental markups.

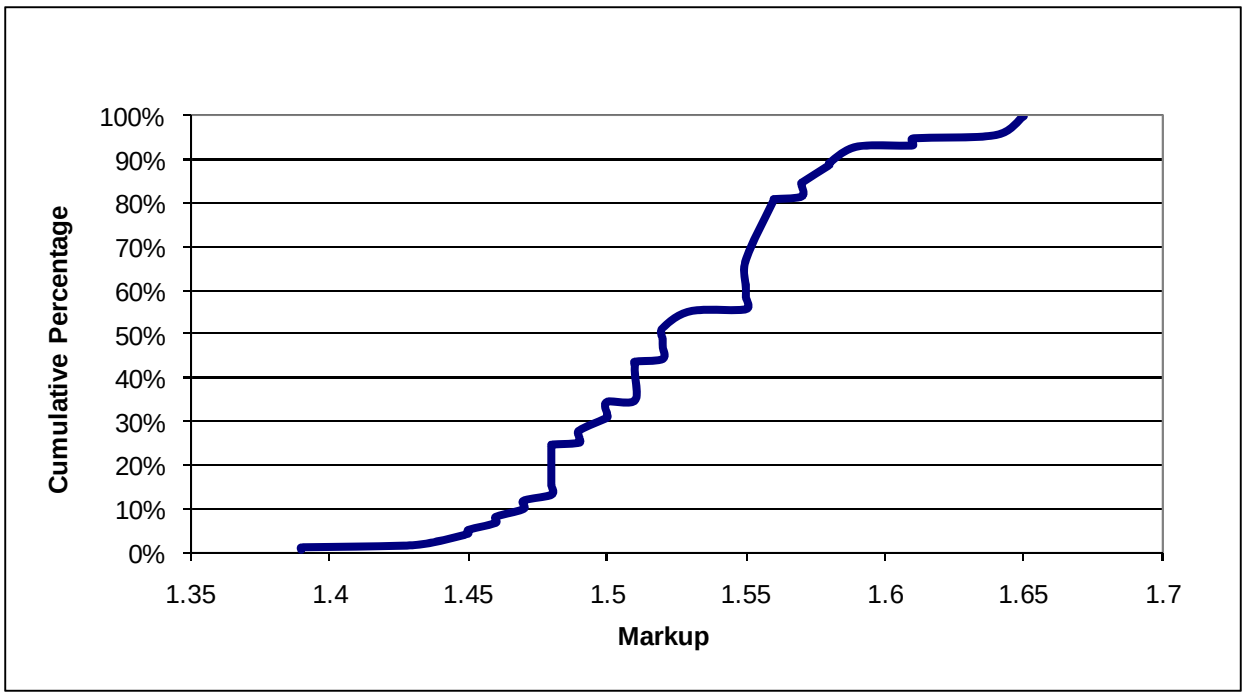

Figure 6.4.1 Cumulative National Sales-Weighted Distribution of Mechanical Contractor Markups for Refrigeration Equipment

6.5 SALES TAX

The sales tax represents State and local sales taxes that are applied to the customer price of WICF units. The sales tax is a multiplicative factor that increases the customer equipment price. DOE derived sales taxes representative of the combined State and local sales tax rates from the Sales Tax Clearinghouse,[10] shown in Table 6.5.1**Error! Reference source not found.**. The State level combined tax rates can be applied to the estimated value of State level WICF equipment shipments to obtain the total purchase cost to the customer located in any State.

The distribution of sales tax rates ranges from a minimum of zero percent to a maximum of 9.4 percent with a mean value of 6.8 percent. DOE applied sales taxes to the customer equipment price irrespective of the distribution channel and the market in which the customer is located.

A weighted-average national level sales tax rate is calculated by multiplying the shares of State level shipments by the tax rates in Table 6.5.1**Error! Reference source not found.**. The distribution of sales tax rates ranges from a minimum of zero percent to a maximum of 9.4 percent with a population-weighted mean value of 6.99 percent. DOE applied sales taxes to the customer equipment price irrespective of the distribution channel and the market in which the customer is located.

Table 6.5.1 State Sales Tax Rates

State	Combined State and Local Tax Rate	State	Combined State and Local Tax Rate	State	Combined State and Local Tax Rate
Alabama	8.15%	Kentucky	6.00%	North Dakota	5.75%
Alaska	1.45%	Louisiana	8.75%	Ohio	6.85%
Arizona	7.15%	Maine	5.00%	Oklahoma	8.10%
Arkansas	8.20%	Maryland	6.00%	Oregon	0.00%
California	9.00%	Massachusetts	5.00%	Pennsylvania	6.25%
Colorado	6.40%	Michigan	6.00%	Rhode Island	7.00%
Connecticut	6.00%	Minnesota	6.85%	South Carolina	7.05%
Delaware	0.00%	Mississippi	7.00%	South Dakota	5.50%
Dist. of Columbia	5.75%	Missouri	7.105%	Tennessee	9.40%
Florida	6.70%	Montana	0.00%	Texas	8.05%
Georgia	6.95%	Nebraska	6.00%	Utah	6.70%
Hawaii	4.40%	Nevada	7.50%	Vermont	6.05%
Idaho	6.05%	New Hampshire	0.00%	Virginia	5.00%
Illinois	8.40%	New Jersey	6.95%	Washington	8.75%
Indiana	7.00%	New Mexico	6.40%	West Virginia	6.00%
Iowa	6.80%	New York	8.25%	Wisconsin	5.40%
Kansas	6.90%	North Carolina	6.80%	Wyoming	5.40%

6.6 NATIONAL ACCOUNTS

Equipment purchased through national accounts constitutes about 70 percent of the usual distribution of WICF equipment to customers. Large customers of WICF equipment use national accounts to circumvent the typical distribution channel, thereby allowing them to negotiate significantly lower equipment prices directly with the manufacturer. The manufacturer in turn must cover additional expenses related to the distribution (as opposed to the manufacture) of the equipment, but gains in terms of negotiating agreed-upon sales volumes with the customer.

To capture the price savings realized from equipment purchased through national accounts, DOE derived a national account markup, assuming that the resulting equipment price increase was one half of that realized from a distribution through the distributor channel. In other words, if the price increase resulting from the distributor markups is $100, the national account markup is such that the price increase is one-half of that, or $50. DOE based the use of a national account markup that is one-half of that realized from the distributor distribution channel on the assumption that the resulting national account equipment price must fall somewhere between the manufacturer selling price (*i.e.*, a markup of 1.0) and the customer price under the distributor distribution channel. Because DOE did not know typical values for the actual national account equipment price, it chose a value of one-half.

To further illustrate the methods for estimation of the national account markup, this section provides the following example of how DOE derived the national account markups. For example, using a baseline manufacturer selling price of $1,000 for a WICF unit delivered to a supermarket and baseline distributor markups of 1.453, the resulting baseline customer equipment price for sales through a distributor (without sales taxes) is $1,453 ($1,000 × 1.453). The dollar value increase due to the above distribution channel markups is $453 ($1,453–

$1,000). Under the assumption that national account customers realize equipment price increases equal to one-half of that through the distribution channel, the dollar value of the equipment price increase under the national account is $226 (one-half of $453). The resulting equipment price is $1,226 ($226 + $1,000), which results in a deduced national account baseline markup of approximately 1.226 ($1,226 ÷ $1,000). A similar calculation results in a deduced national account incremental markup of 1.059 ($1,059 ÷ $1,000).

6.7 OVERALL MARKUP RESULTS

DOE multiplied the distributor, mechanical contractor, and national account markups described above by the weighted average sales tax multiplier to obtain the overall baseline and incremental markups shown in Table 6.7.1 and Table 6.7.2. DOE based overall markups on one of three distribution channels according to how the equipment is purchased: through a national account; a distributor; or a distributor and a mechanical contractor. Also included is the State into which the WICF unit is delivered. Table 6.7.1 presents three overall markups for the overall baseline markup for both multiplex and dedicated-system equipment, and Table 6.7.2 presents the same information for overall incremental markups.

Table 6.7.1 Baseline Markups by Distribution Channel and Overall Weighted Average Markup, Including the Weighted Average Sales Tax Multiplier

	Distributor	Mechanical Contractor (Includes Distributor)	National Account (Mfg Direct)	Overall Weighted Average Markup	
				Multiplex Equipment	Dedicated Equipment
Distributor(s) Markup	1.453	2.209	1.226	1.408	1.828
Sales Tax Multiplier	1.070	1.070	1.070	1.070	1.070
Overall Markup	1.555	2.364	1.311	1.506	1.955

Table 6.7.2 Incremental Markups by Distribution Channel and Overall Weighted Average Markup, Including the Weighted Average Sales Tax Multiplier

	Distributor	Mechanical Contractor (Includes Distributor)	National Account (Mfg Direct)	Overall Weighted Average Markup	
				Multiplex Equipment	Dedicated Equipment
Distributor(s) Markup	1.118	1.375	1.059	1.115	1.252
Sales Tax Multiplier	1.070	1.070	1.070	1.070	1.070
Overall Markup	1.196	1.471	1.133	.1.193	1.340

DOE used the overall markups to estimate the customer price of baseline equipment, given the manufacturer cost of baseline equipment. For example, if the manufacturer selling price of a baseline multiplex WICF unit is $1,000, DOE can multiply this by the weighted-average overall baseline markup to estimate that the baseline customer price of the WICF unit

sold is $1,506. Similarly, DOE used the overall incremental markup to estimate changes in the customer price, given changes in the manufacturer selling price above the baseline due to increases in equipment efficiency. For example, if a new standard for multiplex equipment increases the CRE manufacturer selling price by $100, DOE can multiply this price ($100) by the weighted-average overall incremental markup (1.252) to estimate a customer price increase of $125.

These markups will be used with the MSPs to generate customer prices for commercial refrigeration equipment. Supporting data for calculating baseline and incremental markups are provided in appendix 6A.

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