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An American National Standard

Standard Practice for Life Cycle Cost Analysis of Commercial Food Service Equipment[1]

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1. Scope

1.1 This practice for life cycle cost analysis of commercial food service equipment is designed for producers and end-users to utilize when forecasting and (or) evaluating the life cycle costs of equipment by accounting for tangible differences in operating and maintenance costs of commercial food service equipment. Results of the analysis detailed in this standard practice are intended for budgetary purposes.

1.1.1 The results may also be used to compare projected life cycle cost of different models from a single manufacturer, or models manufactured by multiple suppliers, or to establish when it is cost effective to replace a specific equipment versus incurring continued maintenance expenses.

1.2 Major categories included in this analysis include total purchase price, service and repair costs, preventative maintenance costs, utility operating costs and disposal costs. The results may be quantified as a yearly running total and a net present value.

1.3 Inputs for this life-cycle analysis will need to come from a variety of sources, including manufacturers, service agents, utility companies, and end users. Not all input variables need be considered for effective analysis. To avoid skewing the results, sections where reliable estimates are not available should be left out of the analysis.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F1275 Test Method for Performance of Griddles
F1361 Test Method for Performance of Open Deep Fat Fryers
F1484 Test Methods for Performance of Steam Cookers
F1496 Test Method for Performance of Convection Ovens
F1521 Test Methods for Performance of Range Tops
F1605 Test Method for Performance of Double-Sided Griddles
F1695 Test Method for Performance of Underfired Broilers
F1696 Test Method for Energy Performance of Stationary-Rack, Door-Type Commercial Dishwashing Machines
F1704 Test Method for Capture and Containment Performance of Commercial Kitchen Exhaust Ventilation Systems
F1784 Test Method for Performance of a Pasta Cooker
F1785 Test Method for Performance of Steam Kettles
F1786 Test Method for Performance of Braising Pans
F1787 Test Method for Performance of Rotisserie Ovens
F1817 Test Method for Performance of Conveyor Ovens
F1920 Test Method for Performance of Rack Conveyor Commercial Dishwashing Machines
F1964 Test Method for Performance of Pressure Fryers
F1965 Test Method for Performance of Deck Ovens
F1991 Test Method for Performance of Chinese (Wok) Ranges
F2022 Test Method for Performance of Booster Heaters
F2093 Test Method for Performance of Rack Ovens
F2140 Test Method for Performance of Hot Food Holding Cabinets
F2141 Test Method for Performance of Self-Serve Hot Deli Cases
F2142 Test Method for Performance of Drawer Warmers

[1] This practice is under the jurisdiction of ASTM Committee F26 on Food Service Equipment and is the direct responsibility of Subcommittee F26.05 on Life Cycle Cost and Sustainability.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

F2143 Test Method for Performance of Refrigerated Buffet and Preparation Tables
F2144 Test Method for Performance of Large Open Vat Fryers
F2237 Test Method for Performance of Upright Overfired Broilers
F2238 Test Method for Performance of Rapid Cook Ovens
F2239 Test Method for Performance of Conveyor Broilers
F2324 Test Method for Prerinse Spray Valves
F2379 Test Method for Energy Performance of Powered Open Warewashing Sinks
F2380 Test Method for Performance of Conveyor Toasters
F2472 Test Method for Performance of Staff-Serve Hot Deli Cases
F2473 Test Method for Performance of Water-Bath Rethermalizers
F2474 Test Method for Heat Gain to Space Performance of Commercial Kitchen Ventilation/Appliance Systems
F2519 Test Method for Grease Particle Capture Efficiency of Commercial Kitchen Filters and Extractors
F2644 Test Method for Performance of Commercial Patio Heaters
F2795 Test Method for Performance of Self-Contained Soft Serve and Shake Freezers
F2861 Test Method for Enhanced Performance of Combination Oven in Various Modes
F2975 Test Method for Measuring the Field Performance of Commercial Kitchen Ventilation Systems
F2990 Test Method for Commercial Coffee Brewers

2.2 *ASHRAE Standard:*
ASHRAE Standard 72-2005 Method of Testing Commercial Refrigerators and Freezers[3]

2.3 *ARI Standard:*
ARI Standard 810-2006 Performance Rating of Automatic Commercial Ice Machines[4]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *additional operating costs*—assumes miscellaneous operating expenses required for operation, including consumable supplies, for example, air or water filters.

3.1.2 *additional setup costs/quoted installation*— other installation costs such as material, travel charges etc.

3.1.3 *additional teardown costs*—other special costs that may be incurred and can be allocated to equipment teardown such as special license, dismantling of components containing hazardous materials etc.

3.1.4 *annual electricity consumption (kWh)*—average annual electric power usage rate for the appliance during its lifespan for this analysis in kWh.

3.1.5 *annual gas consumption (therms)*—average annual gas usage rate for the appliance during its lifespan for this analysis in therms.

3.1.6 *annual preventative maintenance costs*— assumes expenses to perform preventative maintenance and repair as outlined by the product's original manufacturer; assumes parts, labor, travel, supplies and additional costs incurred during a fiscal year.

3.1.7 *annual service and repair costs*—assumes expenses to perform non-scheduled service and repair on the product during a fiscal year; includes parts, labor, travel, supplies and additional costs.

3.1.8 *annual water consumption (ccf)*—average annual water usage rate for the appliance during its lifespan for this analysis in thousands of cubic feet.

3.1.9 *annualized maintenance cost*—total annual cost of a service maintenance contract that includes material (parts), labor, travel and other related costs for the period of ownership after the warranty has expired.

3.1.10 *anticipated equipment lifespan (yr)*—expected lifespan of the appliance for the purpose of this analysis or the expected years after which the appliance will be replaced. This may be projected based on input from the manufacturer, dealer, user's experience or expected operating environment.

3.1.11 *discount rate*—discount rate is defined as the rate used to convert future costs or benefits to their present value. Discounting determines the value, in today's dollars, of a benefit that will be realized at a future date. This rate varies according to interest and inflation rates.

3.1.12 *disposal costs*—assumes expenses related to decommission, dismantle, dispose and/or recycle the product at the end of its life cycle.

3.1.13 *electricity rate (USD/kWh)*—electric power rate in USD per kWh. Either the local or regional rate where the appliance is located or national average rate may be used.

3.1.14 *estimated install time (h)*—estimated time to install the appliance in hours.

3.1.15 *estimated teardown time (h)*—labor hours required for teardown.

3.1.16 *extended warranty cost*—cost of extended warranty if not included in purchase price. Typically this includes the additional cost of warranty for equalization of warranty period from different manufacturers.

3.1.17 *freight charges*—cost of shipping the appliance from supplier FOB location to desired destination.

3.1.18 *gas rate (USD/therm)*—gas (natural or propane) rate in USD per therm. Either the local or regional rate where the appliance is located or national average rate may be used.

3.1.19 *hazardous material costs*—special fees or surcharges that may be levied for removal and/or disposal of hazardous materials in the appliance or its components.

3.1.20 *hourly labor cost*—hourly labor rate of servicing the appliance during the first year of ownership period after the

[3] Available from American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, NE, Atlanta, GA 30329, http://www.ashrae.org.
[4] Available from Air-Conditioning and Refrigeration Institute (ARI), 4100 North Fairfax Drive, Suite 200, Arlington, VA 22203.

warranty has expired. Either the local rate where the appliance is located or national average rate may be used.

3.1.21 *hourly labor cost*—the average annual cost of non-unit producing labor in USD/hour to clean and maintain the appliance on a regular basis (excluding preventative maintenance).

3.1.22 *install labor rate*—hourly labor rate for installation labor.

3.1.23 *in-store training/demo costs*—cost of materials, labor or travel for initial training of store personnel and/or demonstration of the new appliance by dealer. This does not include recurring training expense for periodic training or new employee training.

3.1.24 *labor inflation rate*—estimated annual inflation rate of hourly labor rate during ownership period but after the warranty has expired.

3.1.25 *labor rate*—hourly labor rate of servicing technician for teardown of the appliance at the end of appliance lifespan. Either the local rate where the appliance is located or national average rate may be used.

3.1.26 *net present value*—the net present value represents the total amount of funds required to purchase, operate and maintain the equipment of its expected lifespan using the current value of those funds, based on the discount rate.

3.1.27 *operating labor cost*—non-unit producing labor costs includes annual labor to clean and maintain the appliance on a regular basis (excluding preventative maintenance). Unit producing labor costs includes incremental gains due to reduced labor required for production. This is useful for comparing similar but different processes.

3.1.28 *other costs*—other annual costs of servicing the appliance during ownership period but after the warranty has expired, that can be quantified such as supplies, disruption etc.

3.1.29 *parts inflation rate*—estimated annual inflation rate of replacement parts during ownership period but after the warranty has expired.

3.1.30 *purchase price*—net price that will be paid to the dealer or manufacturer for this appliance.

3.1.31 *rebates/incentives*—value of total rebates from utilities, manufacturer, government or any other source, that is not included in purchase price.

3.1.32 *replacement part cost*—cost of parts that will be purchased for service during the first year of ownership period after the warranty has expired.

3.1.33 *setup/installation costs*—assumes expenses to ship the product, install, set-up and conduct initial training.

3.1.34 *sewer rate (USD/ccf)*—sewage water disposal rate in USD per thousand cubic feet (USD/ccf). Either the local rate where the appliance is located or national average rate may be used.

3.1.35 *start-up cost*—any other cost of material, labor or fees that will be paid to start operating this appliance.

3.1.36 *supplies cost*—average annual cost of supplies necessary for operating the appliance efficiently and as recommended by the manufacturer. Examples of such supplies include water filter, oil filter, de-liming solution, replaceable lining etc. but excluding preventive maintenance items.

3.1.37 *supplies inflation rate*—estimated annual inflation rate of supplies during ownership period.

3.1.38 *tax rate*—total state and local sales tax rate as a percentage.

3.1.39 *total accessories price*—cost of accessories required to operate the appliance efficiently. When comparing multiple models, add (or deduct) cost of accessories or options that are needed for equal effectiveness between two models or suppliers.

3.1.40 *total annual electricity cost*—annual cost of electricity for using the appliance in USD.

3.1.41 *total annual gas cost*—annual cost of gas fuel for using the appliance in USD.

3.1.42 *total annual labor cost*—average annual labor costs for operation of the appliance during its lifespan in USD.

3.1.43 *total annual utility cost*—average annual utility costs for operating the appliance during its lifespan in USD.

3.1.44 *total annual water/sewer cost*—annual cost of water and sewer for using the appliance in USD.

3.1.45 *total initial cost*—total cost of appliance that will be used in calculating life cycle cost.

3.1.46 *total installation/commissioning cost*— cost of installation and commissioning that will be used in calculating life cycle cost. Does not include equipment training costs.

3.1.47 *total labor hours*—average annual labor hours expended by non-unit producing personnel during the lifespan of this appliance.

3.1.48 *total teardown/decommissioning cost*—total cost of uninstalling the utility hook-ups from the appliance and removal of any special mounting adaptations.

3.1.49 *utility cost summary*—assumes utility expenses to operate the product during a fiscal year, including electric, gas, water and sewer connection costs.

3.1.50 *utility inflation rate*—estimated annual inflation rate of utilities during ownership period. An average rate for gas, electric and water/sewer may be used for the purpose of this analysis.

3.1.51 *warranty period*—warranty period of the appliance for the purpose of this analyses in years, rounded to 1st decimal.

3.1.52 *water rate (USD/ccf)*—water utility supply rate in USD per thousand cubic feet (USD/ccf). Either the local or regional rate where the appliance is located or national average rate may be used.

4. Summary of Practice

4.1 Detailed information is gathered on the capital outlay, estimated maintenance and operating costs and, if applicable, the disposal costs for a chosen piece of commercial food service equipment. This information may be collected from a