a money saver: life cycle costing

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Energy costs are now part of our decision-making process. Purchasing the most energy-efficient equipment and appliances available results in energy reduction, but the most energy-efficient units often have higher price tags. If price is the major reason in selection and choice during a period of high inflation, how can consumers be motivated to buy the most energy-efficient, but often the higher-priced model? Life cycle costing could provide information needed to show consumers the dollar advantage of buying energy-efficient models.

The elements in a life cycle cost analysis discussed here for major consumer appliances can also be applied by Extension educators to the purchase of machinery, tools, automobiles, or any major item for home, farm, or business use. Equipment is a capital investment. Life cycle costing for capital investment decisions have produced savings for government and industry. The same process could produce savings for individuals as energy and maintenance costs increase.

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Life Cycle Costing

What is included in life cycle costing? There's no current consensus on all elements and factors. Life cycle cost methodology has been used in industry and by the United States Department of Defense (DOD) since 1970 in making purchase decisions.[1] In life cycle cost analysis, 13 factors were used by the DOD. Ruffin simplified the formula by using six elements and factors. Repair and maintenance were considered a part of operating costs.[2] Table 1 indicates elements used by Ruffin, the DOD, and 3 others for life cycle cost analysis.

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Table 1. Elements and factors in life cycle cost analysis.

	Ruffin, 1978 Home appliances[a]	Lund, 1978 Home appliances[b]	DOD 1970-73 Defense projects[c]	DOE, 1980 Federal buildings[d]	DOC, *NBS Handbook* 135, 1980[e]
1.	Purchase price	Acquisition Cost Purchase price Sales tax Transportation	Purchase price Delivery cost Testing cost	Investment costs less salvage	Investment costs less salvage
2.	Installation cost	Installation cost	Installation cost		
3.			Inventory management		
4.			Training		
5.	Operating costs Energy Supplies Maintenance Repair	Operating costs Energy Operator's time	Operating Labor Operating materials Preventive maintenance Corrective maintenance	Energy costs	Energy costs
		Repair and maintenance Routine maintenance Failure repair (excludes warranty)		Nonfuel operation and maintenance costs	Nonfuel operation and maintenance costs
6.	Expected life	Expected lifetime	Service life	Expected life	Expected life
7.	Disposal or trade benefit	Disposal	Residual value	Replacement costs less salvage	Replacement costs
8.	Discount factor (5% rate)	Discount factor	Discount factor (10% rate)	Discount factor (10% rate)	Discount factor (7% rate)
9.	Dismantling	Contractual costs Rental or service contract			

[a]Marilyn Doss Ruffin, "Consumer Appliance Decision," Family Economics Review (Summer, 1978), 10-13.
[b]Robert T. Lund, "Life Cycle Costing as a Societal Instrument," in Research for Consumer Policy, W. M. Denney and Robert T. Lund, eds. (Proceedings of Conference by Center for Policy Alternatives, Cambridge, Massachusetts, March, 1978), pp. 186-87.
[c]U.S., Department of Defense, Life Cycle Costing Procurement Guide Interim, LCC-1 (Washington, D.C.: U.S. Government Printing Office, 1970).
[d]Title 10, Code of Federal Regulations, 436.12, "Life Cycle Cost Methodology," January 1, 1981.
[e]U.S., Department of Commerce, National Bureau of Standards, Life Cycle Cost Manual for the Federal Energy Management Program, NBS Handbook 135 (Washington, D.C.: U.S. Government Printing Office, 1980), p. 25.

Common elements in the five models for life cycle costing are: (1) initial cost, (2) energy cost, (3) maintenance, (4) expected service life, and (5) discount factor. Other elements vary by product and with the specific model.

Initial Cost

Initial cost includes unit cost, sales tax, interest if bought on credit, delivery, and installation. The consumer should consider the following questions and answers and how they affect the initial cost:

- Can the consumer transport and install the appliance, or will delivery and installation be added costs?
- What, if any, energy tax credits are available?
- How much is the consumer's time worth to comparison shop, deliver, and install the appliance?

Energy Cost

Energy cost is a part of operating cost. The energy-guide label found on seven major appliances[3] that are energy intensive is a guide, not the actual energy cost. The consumer needs to determine answers to the questions listed below to estimate the annual energy cost:

- What is the local electric and/or gas rate?
- How frequently and how long will the appliance be used?

Maintenance

Maintenance and nonfuel operating costs include routine maintenance, failure repair, and water. Answers to the following questions affect maintenance and nonfuel operating costs for life cycle costing:

- Will routine maintenance and/or failure repair require a service call by a qualified repair person?
- Will the appliance be used by several people, some of whom may have no or limited experience in use of the appliance?
- Will quality of water available affect maintenance needed?
- Will the location of the appliance in the home adversely affect its use during the winter or summer season and increase maintenance needed?

An alternative to actual experience for maintenance costs is the service contract. The cost of the service contract varies by appliance type, service center, and age of the appliance. The consumer needs answers to these questions before choosing a service contract:

- Does this product have a high frequency-of-repair record?
- Does the cost of the service contract exceed actual experiences with repair costs as reported by others or self?

Answers to these questions aren't readily available to all consumers, but they may be found occasionally in *Consumer Reports.*

Expected Service Life

Life expectancy may be defined as: (1) the actual length of time an appliance lasts or (2) the average length of time the appliance has been kept in use by owners when bought new or when bought used. Income, age, and mobility of head of household are variables that have been found to affect service life. Tippett, Magrabi, and Gray reported service life expectancies for new appliances ranging from 10.8 (washing machine) to 15.2 years (refrigerator).[4] For used appliances, the service life is about one-half that of new (see Table 2).

Table 2. Estimated service life of appliances.

	Service life years	
Appliance	New	Used
Range		
Electric	12.1	5.6
Gas	13.5	6.6
Refrigerator	15.2	7.4
Washing machine	10.8	4.5
Clothes dryer		
Electric	13.7	5.1
Gas	12.8	------
Dishwasher	11.1	6.8

Source: Katherine S. Tippett, Frances M. Magrabi, and Brucey D. Gray, "Service Life of Appliances: Variations by Selected Characteristics of Owner Households," *Home Economics Research Journal,* VI (March, 1978), 189.

Discount Factor

To get a more realistic picture of energy costs over a period of time, a discount factor is used. The discount factor gives the present value of the total energy cost for the expected life of the appliance. A discount rate of seven percent is used in the *Life Cycle Cost Manual.*[5] The best rate would be one that considers projections for energy price increases, an inflation factor, and type of energy used—gas or electricity. Currently, lists of discount factors aren't readily available. Therefore,

consumers must rely on estimated annual energy costs found on energy-guide labels for those appliances having the label. Estimated annual energy costs for nonlabeled appliances may be obtained from some utility companies.

Disposal cost or trade benefit as an element in life cycle costing was included by Ruffin and Lund (Table 1). However, as an element in life cycle costing, it's of limited importance and consumers could eliminate this element without distorting total life cycle cost.

Payback Period

Until life cycle cost methodology is developed as a practical, readily available information tool for consumer use, Extension educators can show clientele the dollar advantage of purchasing the most energy-efficient model of an appliance by using one aspect of life cycle costing—the payback period. This period is the length of time needed for the lower energy bill to pay for the higher purchase price of a product. The procedure for determining the payback period has three steps:

1. Find the difference in the purchase price by subtracting the prices of the two models.
2. Find the difference in average annual energy cost for the two models by subtracting the lower energy bill from the higher.
3. Divide the number obtained in Step 1 by the number obtained in Step 2. The results should indicate the number of years needed to repay the cost of purchasing the lower energy cost model.

For example, two refrigerators:

	A	B	Difference
Purchase price	$549	$619	$70
Average annual energy bill	89	64	25

$70 ÷ $25 = 2.8 years (to repay the higher purchase price).

To determine long-term savings on the energy bill, take the difference in the average annual energy bill and multiply it by the number of years that the appliance will be used. In the above example, the energy bill for refrigerator B would be $380 less than for refrigerator A ($25 annual difference x 15.2 years' service life of a refrigerator = $380). If energy costs rise more than the averaged amount, the difference may be even larger. If all else (repairs and maintenance costs) is equal, this would mean an expenditure of $310 less over the life of the refrigerator (the energy bill difference of $380 minus the higher purchase price differential of $70).

Summary With rapidly rising prices of energy, comparison of purchase prices as a major step in consumer decision making is misleading. For the short-term, payback periods provide vital information to improve consumer choice and lessen energy bills. In the longer term, consumers should be encouraged to make life cycle cost comparisons as information becomes available and readily usable.

Footnotes

1. U.S., Department of Defense, *Life Cycle Costing Procurement Guide Interim,* LCC-1 (Washington, D.C.: U.S. Government Printing Office, 1970).
2. Marilyn Doss Ruffin, "Consumer Appliance Decision," *Family Economics Review* (Summer, 1978), 10-13.
3. Labeled appliances are refrigerators, freezers, clothes washers, dishwashers, water heaters, air conditioners, and furnaces.
4. Katherine S. Tippett, Frances M. Magrabi, and Brucey D. Gray, "Service Life of Appliances: Variations by Selected Characteristics of Owner Households," *Home Economics Research Journal,* VI (March, 1978), 189-91.
5. U.S., Department of Commerce, National Bureau of Standards, *Life Cycle Cost Manual for the Federal Energy Management Program,* NBS Handbook 135 (Washington, D.C.: U.S. Government Printing Office, 1980), p. 25.