Energy Efficiency In Nebraska: A Community Investment

Least Cost Purchasing

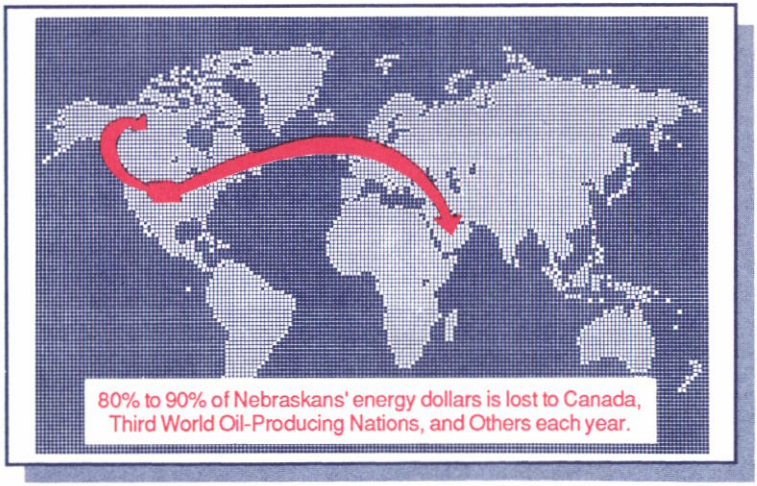
As a Nebraskan, you undoubtedly are aware of troublespots in the state's economy. Problems in the agricultural sectors are exacting a heavy toll from our rural economies in the form of bank closings, farm foreclosures, and a slump in farm implement sales.

Many people think that these problems are too big for them to tackle directly. But opportunities exist to offset these losses in ways that can boost the State's economy and the development of your community.

What Opportunities Do You Have?

Limiting the number of dollars that "leak" out of your community and your state is one way to develop the economy. Limiting leakage is to avoid unnecessary energy use. When Nebraskans pay their natural gas bill or fill up their tank at a gas station, they are effectively draining money from their local economy.

As much as 80% to 90% of the money spent for energy is exported from Nebraska and shipped to the energy-producing regions of the world like Texas, Canada and the OPEC nations. By turning to more efficient uses of energy, this enormous leakage of hard-earned dollars can be slowed.



80% to 90% of Nebraskans' energy dollars is lost to Canada, Third World Oil-Producing Nations, and Others each year.

How Does Energy Efficiency Promote Economic Development?

Reducing energy consumption can benefit your economy by increasing the amount of income available to the community.

Typical Nebraska communities spend thousands and even millions of dollars each year on energy. This spending means there is less money available for purchasing other consumer goods and services which tend to benefit the local economy more than conventional energy purchases like electricity, oil or natural gas.

Energy efficiency improvements benefit the local economy in two ways. First, efficiency boosts the economy directly by providing work for the local contractors, hardware stores and lumberyards which supply the labor and materials needed to make the improvements. Second, money saved from lower energy costs can be spent for other consumer purchases in your town.

How Can Your Local Government Contribute to This Effort?

All levels of government benefit from greater energy efficiency. Energy efficiency improvements in government operations stem the flow of money leaking out of the economy, and boost the economy by increasing local spending.

Because government expenditures are paid largely through taxes, controlling government energy costs can reduce the need for future tax increases. A lower tax rate means that a greater part of personal income is available for other local spending.

There are many ways government can become more efficient in its use of energy. Weatherization of office buildings is one method and cost effective purchases of machines, vehicles, and equipment is another.

How Does Purchasing by Government Effect the Economy?

Any cost reduction in government services or operations can help keep taxes down. Since municipal governments must continually replace worn equipment or purchase new equipment to meet an increased demand for services, purchasing practices influence the cost of government.

In the past, most purchasing decisions were based primarily on purchase price. This frequently resulted in the purchase of inexpensive products that are costly to operate or maintain.

A better way to select affordable equipment is to use life-cycle cost analysis.

What Is Life-Cycle Cost Analysis?

Life-cycle cost analysis is a method by which the estimated total cost of ownership rather than only the initial cost is considered in a purchasing decision. The major costs of ownership for most commodities include the purchase price, the cost of energy, and the cost of maintenance. The greatest challenge in conducting life-cycle cost analysis is to locate reliable and accurate data for the cost of ownership factors.

Life-cycle cost analysis helps municipal governments buy a more cost effective product.

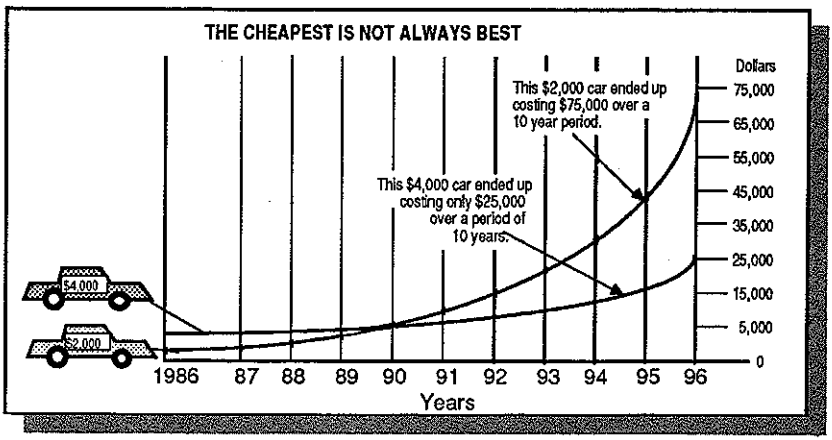
How is Life-Cycle Cost Analysis Done?

Life-cycle cost analysis assumes that the best buy is the product that performs the required tasks and carries the lowest lifetime cost, rather than the product which simply costs less to buy.

A complete life-cycle cost analysis includes purchase cost, salvage costs, maintenance and repair costs, replacement costs and energy costs.

Life Cycle Cost	=	P purchase/ installation	—	S salvage costs	+	M maintenance	+	R replacement cost	+	E energy

For example, suppose the volunteer fire department needed to purchase a new rescue unit. To make the best choice among available models, the department should consider not only the purchase price of each unit, but also its rated miles per gallon, the expected cost of fuel, maintenance costs, warranties for each model, overall performance and possible resale value.



After deciding which units meet the performance standards, the department should purchase the rescue unit which has the lowest estimated total lifetime cost.

Where Do You Find the Data Needed for the Analysis?

Initial cost is whatever you have to pay to obtain the item. This should include purchase price, shipping cost, installation cost and any other direct costs, such as interest or leasing payments which are made prior to the use of the product.

The amount of **energy use** is sometimes difficult to determine, even for commodities which are obvious energy users. Energy use includes the direct use of energy by the equipment or product, and can also include the effect the equipment has on other energy consuming products. For example, in the summer, interior lighting may require a heavier use of air conditioning to offset the heat from the lights.

Currently, only a few products have their energy use calculated under comparable test conditions. Whenever a purchaser asks for manufacturer's data, s/he must specify the conditions under which the data is to be valid. Almost all data on energy use is based on estimated consumption over some period. It is the purchaser's job to determine total yearly energy use from this information.

After collecting information on all the different costs, the next step is "discounting" or converting the cash amounts to present value dollars.

Discounting: Converting Apples into Oranges

Not all expenditures and savings related to a purchase occur immediately. Some costs and benefits occur perhaps six months or a year or even six years after the purchase is made.

It's a classic case of mixing apples and oranges if you aren't careful. Why? The value of money depends on time. First, inflation erodes the buying power of the dollar. Second, you can invest your dollar over time to give you a return which exceeds the rate of inflation. For these reasons, a dollar today may be worth more than a dollar a year from now.

So, you need a way to compare benefits and costs that occur at different points in time--a way to turn all of your apples into oranges so that you can make accurate and economically efficient purchasing decisions. You have to

estimate the values of future expenditures and savings and convert them into their present value.

Present value is the principal of a sum of money payable at some future date. For example, at an interest rate of 10%, the **present** value of $100 you will be paid in one year is almost $91.

Converting future costs and savings to their present value is called **discounting**.

The **discount rate** is the rate of inflation plus the real return on investment. It is the rate at which an investor feels adequately rewarded for tying up money now in exchange for more money in the future. In this booklet, we will use an 8% discount rate--the result of an estimated 4% inflation rate for the next few years and a 4% real return on investment.

Converting Cost Information to Present Value:

You need three formulas to convert the costs of owning a piece of equipment, which are spread over the equipment's lifetime, to their **present value**.

We have included the formulas on page 10 of this booklet.

To simplify your work, we have also performed the calculations these formulas require. The resulting values are listed in the table on page 8. These values are called "factors." There is a different factor for each time period in the life of the equipment, as you will see in column A of the chart called "Factor Values for Life Cycle Cost Analysis" on page 8.

Let's see how the formulas work by using an example. Suppose your community wants to buy a new pickup truck. The purchase cost is $9,000; it will be paid for in equal installments over three years. It has a lifetime of 10 years. After that, it will have a resale value of $2,000. To summarize:

Purchase Cost	=	$9,000
Terms	=	3 years
Lifetime	=	10 years
Energy Costs	=	$250 per year
Maintenance	=	$50 per year
Resale Value	=	$2,000
Discount Rate	=	8% (4% of inflation, 4% real return on investment

Now, let's go to work. First, we need to use the **Uniform Present Worth Formula**. It calculates the present value of a constant sum of money spent each year for a given period of time. It is used to convert the purchase price into present value. Remember, your pickup truck purchase price is $9,000 and will be paid for in equal installments over three years. Your calculations should look like this:

> **$3,000** (amount of each installment payment) x **2.577** (Uniform Present Worth factor for a three-year time period given an 8% rate of inflation; shown on Factor Values Table, page 8) = **$7,731.00** (present value of purchase costs).

The Uniform Present Worth Formula tells us the present value of a sum of money when we are making a uniform series of payments over a specific period of time.

Now, you will turn to the **Modified Uniform Present Worth Formula**. It tells you the current value of costs which change over time--like energy and maintenance on your equipment. These costs are not fixed, and will probably increase over time.

Assume that your pickup truck will run on gasoline and calculate the present value of energy costs over the lifetime of the grader. You will further assume that the cost of gasoline will increase 5% each year. Here's what your calculations should look like:

> **$250** (total energy cost in year one) x **8.593** (Factor value for Modified Present Worth over a ten-year period, assuming annual increase of 5%; shown on page 8) = **$2,148.25** (present value of energy costs over lifetime of equipment)

You can perform the same calculations for the maintenance costs. You'll assume maintenance costs are $50 this year but are expected to increase. Multiply $50 by 8.593 and you've discovered the present value of maintenance costs for the grader.

Finally, you will need to know the present value of the resale value of your truck. The **Single Present Worth Formula** helps you determine the present value for a sum of money which will be received at a given time in the future. In this case, the $2,000 resale value of the truck will be received in 10 years. Your calculations will look like this:

> **$2,000** (resale value of equipment) x **.463** (Single Present Worth factor value for a ten-year period, assuming an 8% rate of inflation; shown on page 8) = **$926.00**.

An Example Of Life-Cycle Cost (LCC) Analysis

You could perform the same calculations for another model of pickup truck and compare the two to discover our best buy in the long run. Your calculations and comparisons might look like these:

	Model One	Model Two
Purchase Cost	$9,000	$8,500
Terms	3 years	3 Years
Energy Costs	$250/year	$500/year
Maintenance	$50/year	$50/year
Life Expectancy	10 years	10 years
Resale Value	$2,000 in year 10	$1,500 in year 10

Discount Rate = 8%
Energy Price Escalation Rate = 5% per Year

The calculations look like this:

MODEL ONE		MODEL TWO	
Purchase Cost	$3,000 X 2.577 = $7,731.00	$2,833.33 X 2.577	= $7,301.50
Energy Cost	$ 250 X 8.593 = $2,148.25	$ 500 X 8.593	= $4,296.50
Maintenance	$ 50 X 8.593 = $ 429.65	$ 50 X 8.593	= $ 429.65
Subtotal of Life Cycle Cost	= $10,308.90		$12,027.65
Resale Value	$2,000 X .463 = — 926.00	$ 1,500 X .463	= — $694.50
Present Value of Total LCC	= $9,382.90		$11,333.15

So, even though model one costs $500 more initially than model two, model one will be less expensive over its ten-year life expectancy.

Factor Values for Life Cycle Cost Analysis			
A	B	C	D
No. of Years	Uniform Present Worth Formula	Modified Uniform Present Worth Formula	Single Present Worth
	i = 8%	e = 5%	i = 8%
1	0.926	0.972	0.926
2	1.783	1.917	.857
3	2.577	2.836	.794
4	3.312	3.730	.735
5	3.993	4.598	.681
6	4.623	5.443	.630
7	5.206	6.264	.583
8	5.747	7.062	.540
9	6.247	7.838	.500
10	6.710	8.593	.463
11	7.139	9.326	.429
12	7.536	10.039	.397
13	7.904	10.733	.368
14	8.244	11.407	.340
15	8.559	12.062	.315
16	8.851	12.699	.292
17	9.122	13.319	.270
18	9.372	13.921	.250
19	9.604	14.507	.232
20	9.818	15.076	.215

Where Can You Find More Information on Life Cycle Costing and Energy Efficient Purchasing?

Here are several sources of information on purchasing. These groups have expertise in the field and are willing to provide assistance.

- National Institute of Government Purchasing, Inc. is a non-profit society of governmental purchasing agents from the United States, Canada, and Puerto Rico. The society trains purchasing agents and provides information through a series of guidebooks, including "Alternatives for Space Heating and Hot Water" and "Building Energy Management". The society can be reached at 1735 Jefferson Davis Highway, Arlington, Virginia 22202. Phone (703) 533-7300.

-National Community Energy Management Center. The Center was established to provide technical assistance and training to the nation's cities and counties. The center specializes in identifying energy management techniques and implementing energy saving procedures. The society has worked closely with the National Institute of Government Purchasing, Inc. and can be reached at The Academy for State and Local Government, 444 North Capitol Street N.W., Suite 349, Washington, DC 20001. Phone (202) 638-1445.

-Product Information Network. The Product Information Network is a national information source which offers periodic newletters, and books discussing issues relative to city management. An example of a recent booklet is "Pavement Management Systems-Preserving Streets Through Maintenance Planning". A recent newsletter focused on forecasting, discussing energy, wages, general operation and maintenance and other municipal utilities. The mailing adress is McGraw-Hill, 1221 Avenue of the Americas, New York, NY, 10020.

-Public Works. Many purchasing agents across the nation subscribe to the magazine Public Works. It provides information on a variety of topics, including equipment comparisons, new technological equipment offerings, and reviews of city management procedures. In addition, Public Works contains promotional information on numerous equipment types and distributors. Public Works is published by the Public Works Journal Corporation, Box 688, Ridgewood, NJ 07451

Your Knowledge Will Benefit Your Entire Community

Users of life cycle costing must understand that this is a decision-making technique based upon estimation. Using the technique is not a guarantee that the actual cost will equal the projected costs at the end of the expected life of the product. How closely the actual costs conform to the projected costs depends on the validity of the data used for the calculations and the operation and maintenance of the equipment purchased.

Once local purchasing officers have mastered the technique of life cycle cost analysis and are capable of purchasing the products with the lowest acquisition and operating costs, they can be a resource for energy efficient purchasing information for the rest of the community.

Businesses, churches and households can all slow the leakage of energy dollars from their town by buying energy efficient equipment and appliances; and purchasing officers can help by sharing their knowledge of life-cycle cost

analysis with the community. With a little practice, every equipment and appliance purchase can be made in such a way to maximize its local economic development potential.

Formulas

UPW - Uniform Present Worth Formula $P = A \frac{(1+i)^N - 1}{i(1+i)^N}$

An end-of-period payment (A) times UPW factor for appropriate discount rate (i) gives (P) a present sum of money equivalent (A) over (N) discount periods.

UPW* - Modified Uniform Present Worth Formula $P = A \frac{(1+e)}{(1+i)} \left[1 - \left(\frac{1+e}{1+i}\right)^N\right]$

An end of base year payment (A) times UPW* factor for appropriate discount (i) and price escalation rate (e) gives (P) a present sum of money equivalent to (A) escalating at a rate (e) over (N) discount periods.

SPW - Single Present Worth Formula $P = F \frac{1}{(1+i)^N}$

A future sum of money (F) times SPW factor for appropriate discount rate (i) gives (P) present value of (F).

Correction: The Uniform Present Worth Formula should read:

$$P = A \frac{(1+i)^N - 1}{i(1+i)^N}$$

Correction: The Modified Uniform Present Worth Formula should read:

$$P = A \frac{(1+e)}{(i-e)} \left[1 - \left(\frac{1+e}{1+i}\right)^N\right]$$

STATE OF NEBRASKA

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